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FLATHEAD BASIN FOREST PRACTICES
WATER QUALITY AND FISHERIES
COOPERATIVE PROGRAM

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APPLICATION OF THE MONTANA NONPOINT SOURCE STREAM REACH ASSESSMENT IN THE FLATHEAD BASIN

BY STEVE TRALLES

JUNE 1991

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ABOUT THIS REPORT

This report is one of ten individual studies conducted for the Flathead Basin Forest Practices/ Water Quality and Fisheries Cooperative Program. The Cooperative Program was administered by a Coordinating Team representing the Montana Department of State Lands Forestry Division, the Flathead National Forest, Plum Creek Timber Company, L.P., the Montana Department of Fish, Wildlife and Parks, the Montana Department of Health and Environmental Sciences' Water Quality Bureau, the University of Montana, and the Flathead Basin Commission.

The Cooperative Program's specific objectives were (1) to document, evaluate, and monitor whether forest practices affect water quality and fisheries within the Flathead Basin, and (2) if detrimental impacts exist, to establish a process to utilize this information to develop criteria and administrative procedures for protecting water quality and fisheries.

The ten individual studies included the evaluation of: (1) specific practices at the site level, (2) accumulation of practices at the watershed level, (3) general stream conditions, (4) water quality variables relative to levels of management activity in small watersheds, (5) fish habitat and abundance relative to stream variables influenced by forest practices at the watershed level, (6) long-term changes in large-stream dynamics related to historical records of natural and man-related disturbances, and (7) changes in lake sediments relative to historical records of natural and man-related disturbances. A *Final Report* was developed which contains summaries of each of the studies, a set of summary conclusions and recommendations, and a formal response to the recommendations by the land management organizations which administered the Cooperative Program.

CONTRIBUTORS

- U.S. Forest Service—Flathead National Forest
- Plum Creek Timber Company, L.P.
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- Montana Department of Fish, Wildlife and Parks
- Flathead Basin Commission
- Montana Environmental Quality Council
- Montana Chapter of the American Fisheries Society
- Governor's Office, State of Montana

FLATHEAD BASIN FOREST PRACTICES
WATER QUALITY AND FISHERIES
COOPERATIVE PROGRAM

APPLICATION OF THE MONTANA NONPOINT SOURCE STREAM REACH ASSESSMENT IN THE FLATHEAD BASIN

BY STEVE TRALLES

JUNE 1991

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FLATHEAD BASIN FOREST PRACTICES/WATER QUALITY AND FISHERIES COOPERATIVE STUDY

APPLICATION OF THE MONTANA NONPOINT SOURCE STREAM REACH ASSESSMENT IN THE FLATHEAD BASIN

PREPARED BY
Steve Tralles

Montana Department of Health and Environmental Sciences
Water Quality Bureau
Helena, Montana

EXECUTIVE SUMMARY

In 1989 the Department of Health and Environmental Sciences/Water Quality Bureau developed the nonpoint source pollution stream reach assessment procedure. The statewide assessment procedure was designed to inventory and prioritize stream reaches that are thought to be moderately or severely impaired by nonpoint source pollution (NPSP). This subjective field procedure is meant to assess stream conditions and degree of impairment to aquatic beneficial uses, relative to NPSP and contributing hydrologic influences.

For this study, the primary beneficial use of concern was fisheries. The degrees of impairment are defined as non-impaired or non-impaired but threatened (fully supporting), minor or moderate impairment (partially supporting), and severe impairment (non-supporting).

The assessment procedure was applied to 30 streams (95 separate stream reaches) in the Flathead River Basin. The assessments were conducted as one of ten separate study modules for the Flathead Basin Forest Practices/Water Quality and Fisheries Cooperative Study.

The objectives of the stream assessment study were to 1) identify impaired stream reaches, 2) evaluate the accuracy and sensitivity of the assessment procedure by comparison with quantitative study module results.

Assessments conducted during this study indicated that over half of the streams (53%) and individual stream reaches (54%) are non-impaired or non-impaired but threatened. However, 44 percent of the streams and 41 percent of the stream reaches exhibited minor or moderate impairment. Only one stream and five stream reaches were assessed as severely impaired.

To evaluate accuracy and sensitivity of the assessment procedure, qualitative assessment results were compared to results of quantitative studies conducted under this cooperative. Comparisons were made with two modeling procedures, Sequoia (watershed disturbance), and H2OY (water yield). Comparisons were also made with quantative fisheries habitat evaluation (substrate embeddedness and percent fines) and with channel stability ratings. Comparisons indicated inconsistent results between the

qualitative assessments and various quantative methods.

The assessment procedure, as initially designed, is an unreliable predictor of impairment to beneficial uses for streams where impacts are subtle or less conspicuous, such as the majority of those in the Flathead Basin. The assessment procedure may still be useful for identifying severe or obvious stream impairments.

Modifying the assessment procedure to incorporate quantitative measurements such as substrate score and increasing areas of observation could improve the resolution of the procedure. However, subtle impairment may best be identified by the use of quantative monitoring techniques.

ACKNOWLEDGEMENTS

I am grateful to the numerous people that took the time to review the initial assessment form and provide helpful criticism and recommendations to improve the procedure. Reviewers included persons from the Montana Department of Fish Wildlife and Parks, Montana Water Quality Bureau (WQB), University of Montana, Flathead National Forest, Soil Conservation Service, U.S. Forest Service Region-1 Supervisors Office and Intermountain Range and Experimental Station, Weyerhauser, Potlatch Corporation, and Trout Unlimited. Larry Brown of Plum Creek Timber Company, (formerly of the WQB) provided initial technical assistance and advice in developing the assessment form. John Gangemi, completed all field assessments in a timely manor, despite long hours, poor weather conditions and a less than hospitable bull moose. Dean Sirucek and Mike Enk were particularly helpful in providing John Gangemi with technical and logistical support for completing this project, as were other personnel from all Ranger Districts on the Flathead National Forest. Tom Vars of the Stillwater State Forest also provided John with assistance. The Flathead National Forest provided narrative stream descriptions written by John Gangemi and Liz Hill, of which portions were excerpted for Appendix D of this report. Loren Bahls and Mark Kerr reviewed and edited this report and Patty Rowsey assisted with typing. The contributions of all these individuals were very helpful and are greatly appreciated.

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INTRODUCTION / BACKGROUND

Nonpoint source pollution (NPSP) originates from diffuse runoff, seepage, drainage, or infiltration and is often associated with rain storms or snow melt. NPSP is the major cause of aquatic degradation in Montana. The major activities that cause NPSP, in order of significance, are agriculture, hydromodification, mining and forest practices (Montana Water Quality Bureau 1990).

As mandated by Section 319 of the 1987 Federal Clean Water Act, each state has developed a statewide NPSP management plan. In Montana, this plan designates administrative responsibilities and lays the framework for identification and resolution of NPSP problems. One major aspect of the management plan is to identify NPSP impairments and rank impaired waters for cleanup priority.

Recognizing the limited availability of time, people and money and the need to provide a standard, initial screening method to identify and prioritize all streams suspected of being impaired by NPSP, the Montana Department of Health and Environmental Sciences, Water Quality Bureau developed the NPS Steam Reach Assessment Procedure.

The requirements of the assessment procedure were that it be relatively simple and fast, applicable statewide, and that it identify both human and hydrologic or natural influences on a stream. Consequently, the procedure is subjective and non-quantitative.

The NPS Stream Reach Assessment is designed to evaluate stream conditions and perceived impairment to beneficial uses relative to NPSP and hydrologic influences. Impairment is defined as the degree to which a stream or stream reach will support designated beneficial uses. For the purpose of this study the primary beneficial use is fisheries. Specific land management activities and associated best management practices are also evaluated by the assessment.

In the Flathead River Basin, one third of the watershed is composed of commercially managed forested lands (Flathead Basin Commission 1988). Although forest practices effect only 13% of the impaired stream miles in Montana (Montana Water Quality Bureau 1990), these streams provide some of the highest water quality and most valuable fisheries habitat in the state (Flathead Basin Commission 1989). The upper Flathead River Basin is no exception.

Forest practices, including road construction, remove vegetation and disturb the ground surface which can cause soil erosion and stream sedimentation. Sedimentation may have a direct or cumulative negative affect on beneficial uses such as fish and other aquatic organisms. Vegetation removal may also contribute to increases in peak stream flow causing channel instability and subsequent aquatic habitat degradation (Sullivan, et al. 1987).

In 1988, the Flathead Basin Commission sanctioned the Flathead Basin Forest Practices/Water Quality and Fisheries Cooperative Study. Objectives of the cooperative were in part, to document, evaluate, and monitor the effects of forest practices on aquatic resources in the Flathead Basin, and also, to determine a resolution for problems if they exist (Flathead Basin Commission 1988). Ten integrated study modules were developed to address the objectives. In general, these study modules addressed: 1) historical timber harvest and its effect on stream flow and lake sedimentation; 2) effects of logging on nutrients, macroinvertebrates, and primary production in streams; 3) effects of fine sediments on spawning and rearing of cutthroat and bull trout; 4) assessment of best management practices; 5) guidelines for streamside management zones; 6) application of computer models to determine watershed risk as related to timber harvest, and 7) correlation studies that compared results of all modules.

DHES was actively developing the nonpoint source stream reach assessment procedure at the conception of this cooperative. It was presumed that this procedure could be applied to streams in the Flathead and that the reliability of the method could be tested against the more quantitative studies. The stream reach assessment proposal was presented to and accepted by the Flathead Basin Steering Committee for inclusion as a study module.

The overall goal of this study was to produce a useable NPSP stream reach assessment procedure with two main objectives in mind. The first objective was to identify streams impaired by NPSP and/or hydrologic factors and second to assess the accuracy of the procedure in identifying impairment by comparing results with other quantative studies.

It is important to remember that the assessment procedure is primarily designed to identify moderate and severe stream impairment to prioritize the worst problems in Montana.

STUDY AREA

The upper Flathead River Basin covers approximately 10,600 sq km and contains over 3900 km of streams (Montana Water Quality Bureau 1990). The Flathead River system consists of the North, Middle and South Forks that form the mainstem, which ultimately flows into the Columbia River via Flathead Lake the Clark Fork River, and the Pend Oreille River.

Primary land uses in the basin are timber harvest, recreation, agriculture, urban development and industry. Stream siltation related to forest practices is the leading cause of NPSP in the Flathead Basin (Flathead Basin Commission 1990).

Water quality in the Flathead Basin is generally very high. Streams and lakes in the basin support a variety of aquatic life, including bull trout and west slope cutthroat trout, both species of special concern in Montana.

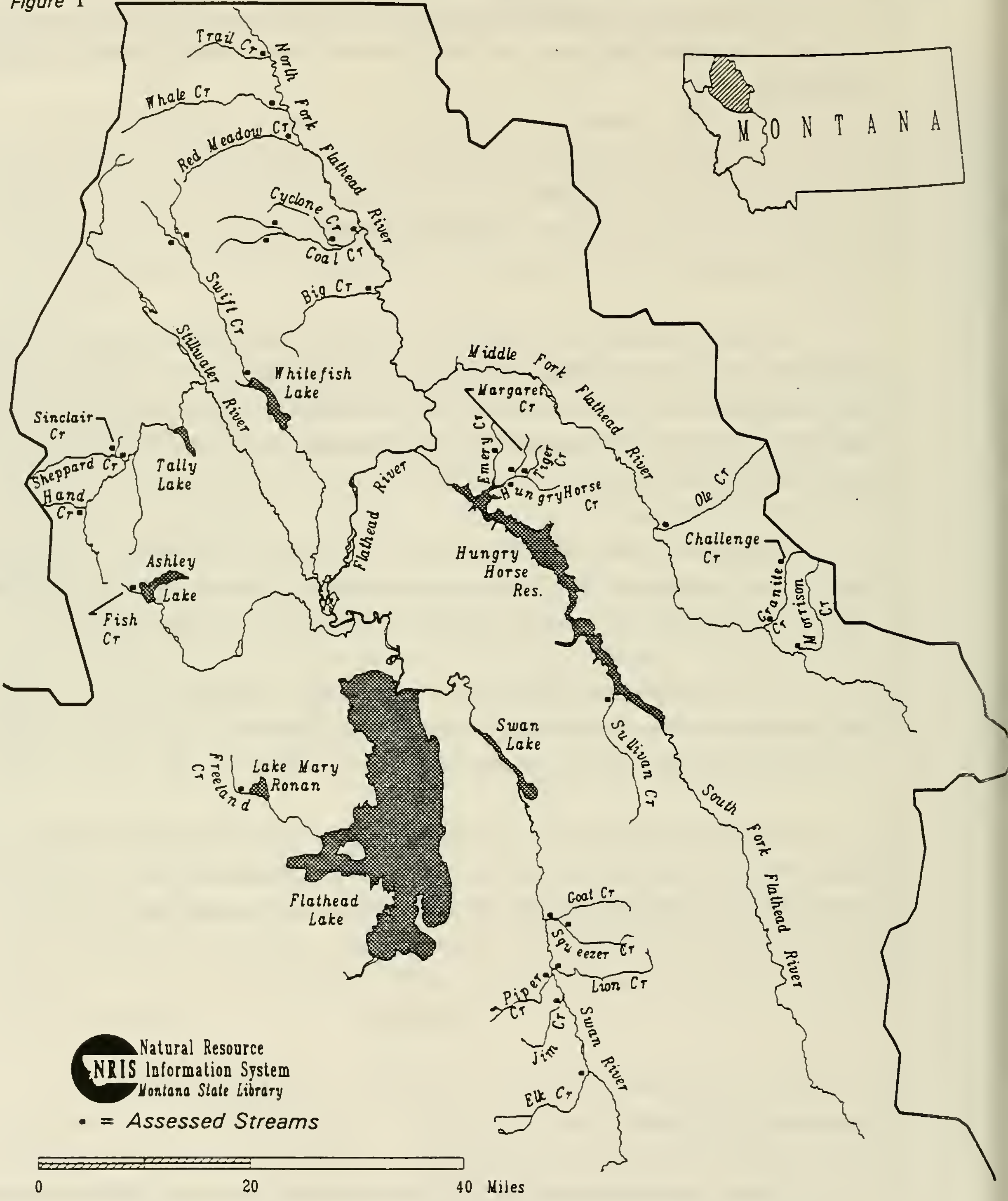
Nonpoint source stream reach assessments were conducted on 30 fourth to first order streams (containing 95 reaches), throughout the basin (Figure 1). The streams were selected to correspond to sample sites of the other cooperative studies.

METHODS

Assessment Procedure

Stream reach assessments were conducted by one contracted field surveyor using protocols set fourth in the NPS Stream Reach Assessment Field Form developed by DHES/WQB (Appendix A.)

Figure 1



COMPLETED NPSP STREAM REACH ASSESSMENTS

Upper Flathead River Basin

The procedure entails spot check observations at selected points within each stream reach. To maximize time efficiency, the surveyor choose the most accessible observation points that allowed adequate identification of potential impairments within each reach. Relatively homogenous stream reaches were defined by the surveyor and based on a combination of factors such as stream gradient, valley bottom shape, vegetation, substrate, stream order, or land uses. Prior to conducting the field work, the surveyor used aerial photos and topographic maps to assist in predetermination of stream reaches and observation sites. Final determination of reaches and observation points was made in the field.

At each observation point the surveyor attempted to observe at least one riffle, run and pool. Adjacent land features, or management practices where applicable, were also evaluated. Conditions relative to evaluation categories found on the field form were noted at each observation point. A stream reach assessment field form was completed for each reach and based on collective information from each observation point within that reach. The surveyor can usually assess 10 to 20 miles of stream per day depending on accessibility. Walking long distances of each stream was avoided to retain the rapid approach of this method. Consequently, assessment of unroaded portions of the streams was often based on limited observation points.

The assessment form is designed to evaluate natural or hydrologic and human induced factors that influence stream condition. The assessment form rates 16 individual evaluation categories (Table 1). Categories one through eight evaluate general and/or natural impairment indicators. Categories nine through sixteen evaluate more specific indicators of impairment.

The assessment form also contains one page for rating best management practices (BMPs) or mitigative measures incorporated with management activities that are designed to protect water resources from NPSP (see Appendix A). This section of the form allows the surveyor to describe and assess implementation of BMPs. This section provides supporting information for ratings of individual categories, but is not used for the final impairment rating.

It should be noted that the last eight categories (9 - 16) did not generally apply to streams in this study area. These categories focus on obvious, specific impairment indicators such as salts, turbidity, water odor and dewatering. For the purpose of this

Table 1: Assessment Form Evaluation Categories

1. Natural Erosion
2. Land Use
3. Nonpoint Source Pollution
4. Bank Stability
5. Substrate Composition
6. Channel Stability
7. Streamside Vegetation
8. Channel Modifiers
9. Turbidity
10. Water Surface Oils
11. Precipitates (Other Than Sediment) On The Channel Bottom
12. Salinization
13. Foreign Debris
14. Water Odor
15. Dewatering

16A. Fisheries

16B. Aquatic Plant Growth

study these categories were not used to determine overall impairment ratings. Appendix B describes all evaluation categories contained on the stream reach assessment form.

Impairment Ranking

For the purpose of this assessment procedure, impairment is defined as the perceived degree to which a stream will support designated beneficial uses. Designated beneficial uses are defined by the Administrative Rules of Montana (Montana Water Quality Bureau, 1988). The primary designated beneficial stream uses are drinking, food processing, swimming, recreation, agriculture, industrial and propagation of trout, and associated aquatic life. This study focused primarily on fisheries.

A numerical ranking system was developed for the assessment procedure (Appendix C). The numerical ranking determines an impairment value for each reach. Each evaluation category is divided into three or four subjective descriptions essentially ranging from good to bad. Numbers are assigned to each descriptive category. Several category values are weighted more than others depending on perceived influence on stream condition. These categories are: **Bank Stability, Substrate Composition, Channel Stability,** and **Streamside Vegetation.**

To determine an overall impairment ranking for each reach, the sum of rated values for each category is divided by the total possible for those categories rated. The categories that are actually rated and consequently, the total possible, may vary from reach to reach depending on conditions encountered during the assessment (i.e. extreme turbidity may preclude substrate evaluation). The final impairment value is a percentage of the total possible for each reach. The final ranking or percentage is then converted into one of five impairment rankings. Impairment values are assigned as follows:

87 -100% = Non-impaired, (full support)
80 - 86% = Non-impaired, but threatened, (full Support)
71 - 79% = Minor impairment, (partial support)
56 - 70% = Moderate impairment, (partial support)
0 - 55% = Severe impairment (non-support)

The impairment values were arbitrarily defined by setting 55% as non-supporting and dividing the remainder to 100%. It is assumed that any reach rated below 55% has serious impairment and probably does not support a healthy and diverse fisheries population or the majority of other beneficial uses.

To define these values, several streams of known condition were assessed. These conditions were established by using a combination of personal knowledge and previous monitoring information. The condition of these streams ranged from poor to excellent. Impairment values were calculated for each stream and initial rating values calibrated to fit the known condition.

The 1989 assessment form that was used for this project was slightly modified after field work for this project was completed. The numerical ranking criteria were designed to fit the most recent edition of the field form. Consequently, in some cases the original categories were either not rated, or subjective interpretation was necessary to assign values to the original forms. Interpretations were applied as consistently as possible, however any inconsistency should not have significantly affected the overall rating.

Comparisons

To evaluate the accuracy and sensitivity of this procedure, the assessment results were compared to the results of several quantitative studies conducted as part of this cooperative.

The overall impairment value, averaged by stream, was compared to relative watershed activity level derived by the SEQUOIA [cumulative runoff acreage] (USDA 1981), (Potts and McInerney 1991) and H2OY, [predicted water yield increase] (Isaacson 1977), (Sirucek, et al. 1991) computer models.

Assessed stream reaches were compared to corresponding reaches that had USFS Region 1 Channel Stability Ratings [CSR] (Pfankuch 1978), (Sirucek, et al. 1991), and fish habitat data (Weaver and Fraley 1991).

Assessment comparison with the CSR was made by establishing an impairment value based only on four categories from the assessment form. The four categories were: **Bank Stability, Substrate Composition, Channel Stability,** and **Channel Modifiers.**

These categories were selected because of direct applicability to parameters on the CSR.

The assessment category of **Substrate Composition** is in part, designed to evaluate stream substrate relative to sediment influence on fish spawning and rearing habitat . For corresponding reaches, **Substrate Composition** was compared to stream substrate score and percent fines ($<$6.35 mm dia.) as reported by the fisheries study (Weaver and Fraley 1991).

All comparisons were made by ranking reported values and applying nonparametric statistical analysis. The Kendall Rank-Order Correlation (tau) test was used for analysis. A z test statistic applied to the tau value was significant at the .05 level when greater than +/- 1.96.

RESULTS/DISCUSSION

RESULTS

Assessments were conducted on 30 streams containing 95 reaches. Table 2 lists streams by order of impairment. Of the 30 streams assessed, 47 percent were rated as having minor, moderate or severe impairment (Figure 2). Of the 95 stream reaches assessed, 46% percent were rated as impaired (Figure 3). Appendix D contains a summary of the assessment results.

In comparing the individual assessment categories, **Land Use** contributed to impairment on 72 percent of the assessed reaches. **Land Use** (as assessed) is a measure of potential risk based primarily on the distance from the stream that management activity has occurred. **Channel Stability** and **Substrate Composition** contributed to impairment on approximately 30 percent of the assessed reaches. Figure 4 summarizes the percentage of reaches where specific assessment categories contributed to impairment.

The character and extent of management of the assessed stream reaches varied considerably throughout the basin. Of the 95 assessed reaches, 75 were managed to some extent and 20 were unmanaged or "pristine". Timber harvest and roads accounted for the majority of management activity though livestock grazing occurred on several reaches.

Table 2: Streams Ordered by Impairment Value

STREAM NAME	RATING	IMPAIRMENT
SINCLAIR	41.5%	SEVERE
OLE	60.0%	MODERATE
W. FK. SWIFT	63.0%	MODERATE
E. FK. SWIFT	66.0%	MODERATE
SWIFT	66.0%	MODERATE
GRANITE	71.0%	MINOR
CHALLENGE	71.0%	MINOR
FISH	74.0%	MINOR
MORRISON	75.0%	MINOR
GOAT	76.0%	MINOR
SHEPPARD	77.0%	MINOR
ELK	77.0%	MINOR
RED MEADOW	78.0%	MINOR
LION	79.0%	MINOR
WHALE	81.0%	NONE, BUT THREATENED
SULLIVAN	81.0%	NONE, BUT THREATENED
S. FK. COAL	81.0%	NONE, BUT THREATENED
PIPER	82.0%	NONE, BUT THREATENED
SQUEEZER	86.0%	NONE, BUT THREATENED
JIM	86.0%	NONE, BUT THREATENED
COAL	87.0%	NONE
EMERY	87.0%	NONE
HUNGRY HORSE	89.0%	NONE
N. FK. COAL	90.0%	NONE
CYCLONE	91.0%	NONE
HAND	91.0%	NONE
BIG	91.0%	NONE
MARGARET	92.0%	NONE
TRAIL	93.0%	NONE
TIGER	94.0%	NONE

Impairment Values

87 - 100% = Non-impaired
80 - 86% = Non-impaired, but Threatened
71 - 79% = Minor Impairment
55 - 70% = Moderate Impairment
0 - 54% = Severe Impairment

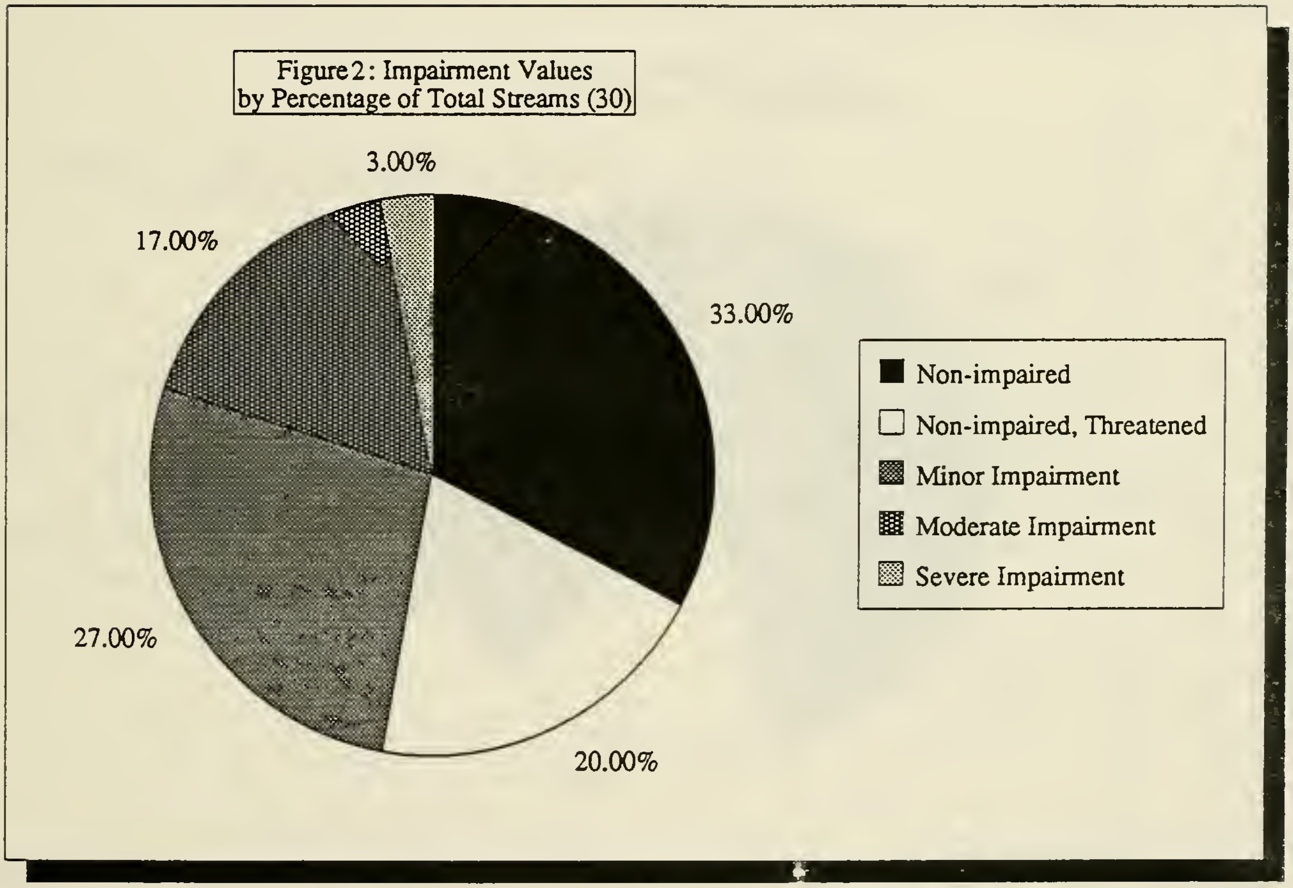


Figure 2: Impairment Values by Percentage of Total Streams (30)

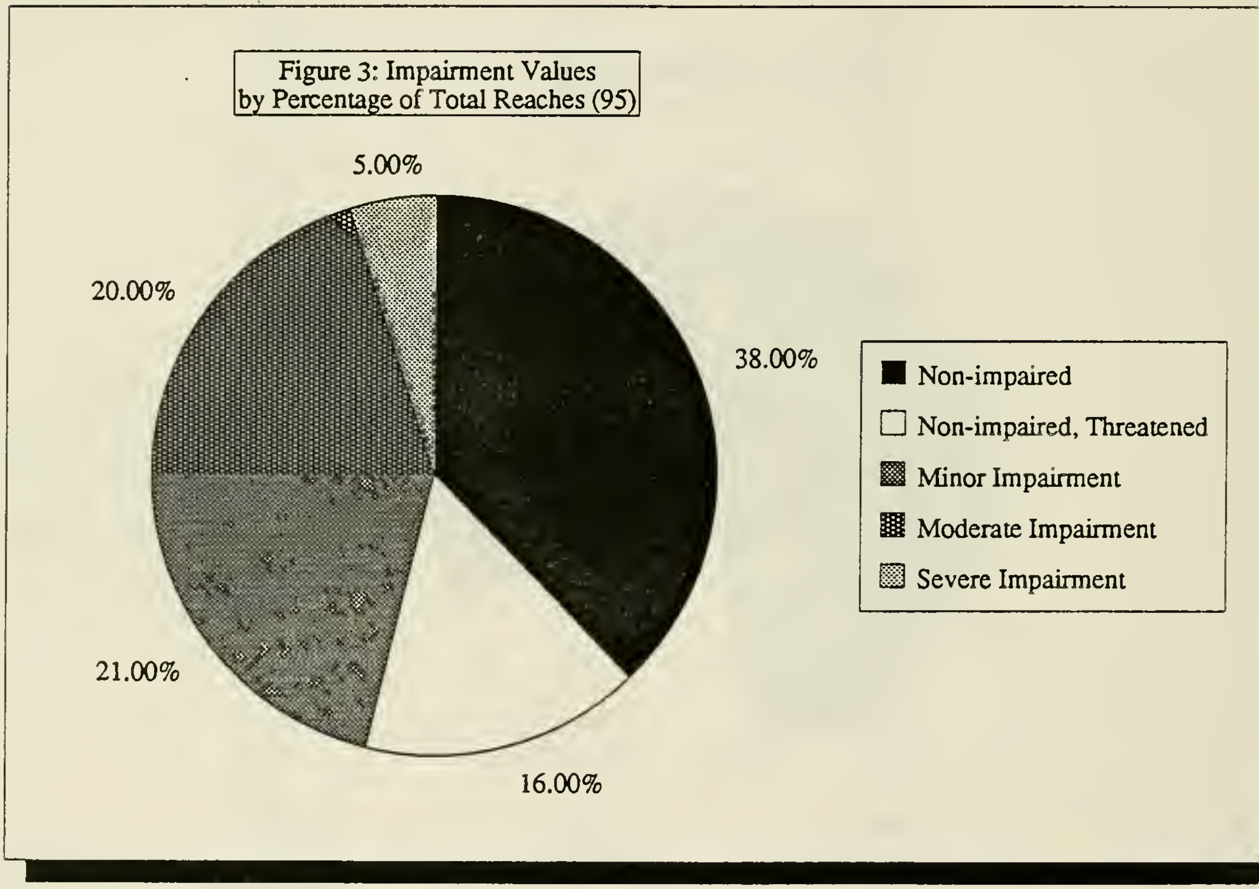
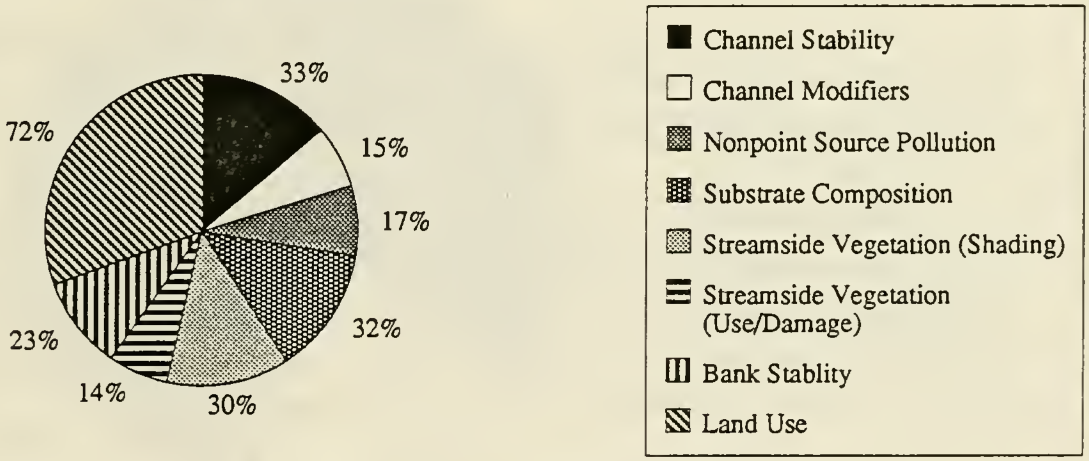


Figure 3: Impairment Values by Percentage of Total Reaches (95)

Figure 4: Assessment Categories Rated as Impaired by Percentage of Total Reaches (95)



Of the "managed" stream reaches assessed, 48 percent were impaired to some extent and 52 percent were unimpaired. Of the unimpaired reaches 33 percent were rated as threatened (Figure 5).

While conducting assessments, several management activities were identified by the surveyor as either contributing to stream impairment or having a good potential to cause problems in the future. Observed sedimentation was attributed to timber harvest, roads, and livestock. Inadequate streamside management zones for logging units, poor road surface maintenance, and bank trampling by livestock were the primary problems. Table 3 summarizes this information.

Of the 20 "unmanaged" stream reaches assessed, 40 percent were impaired and 60 percent unimpaired (Figure 6). The impaired reaches were affected primarily by natural erosion and bank or channel instability.

Comparison of impairment ratings, by stream, to activity values derived from the SEQUOIA and H2OY models revealed a non-significant correlation. There was no trend in impairment ratings relative to activity levels.

Modified impairment ratings were compared to results of the R1 Channel Stability Survey (CSR). Comparisons were made on eight corresponding stream reaches. Correlation between these methods was significant, but negative ($z = -2.23$). An inverse relationship is expected since high CSR values reflect poor channel conditions and high assessment values (modified) indicate low impairment.

For corresponding reaches, the **Substrate Composition** category from the assessment was compared to percent fine sediment ($<$ 6.35 mm dia.) and channel substrate scores. Again, the correlation was not significant. The assessments results generally revealed less impairment than results of the quantative fisheries habitat study.

DISCUSSION

This cooperative effort allowed the DHES/WQB to test a new method of subjective stream assessment against less subjective, quantitative studies of watershed disturbance, fisheries habitat, and stream channel stability.

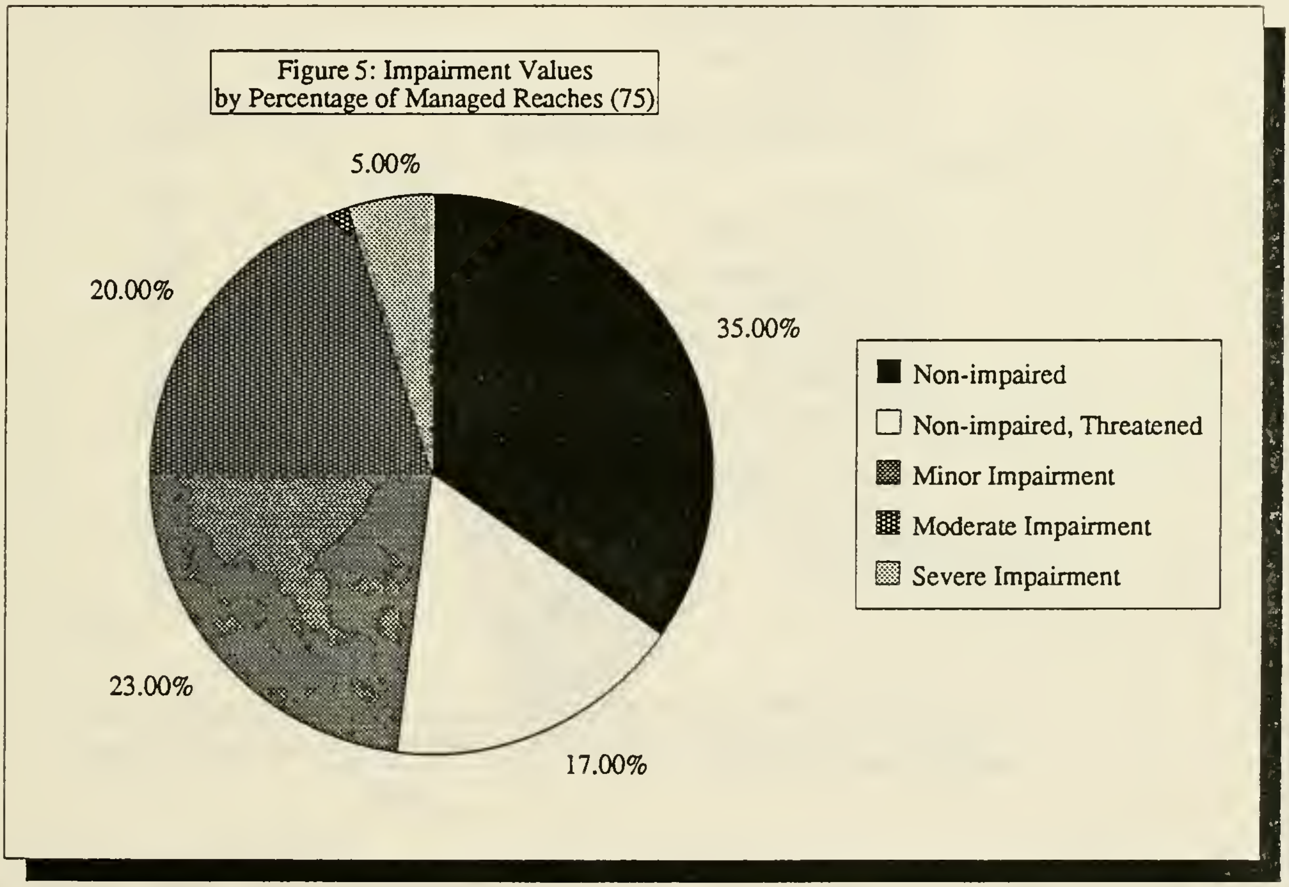


Figure 5: Impairment Values by Percentage of Managed Reaches (75)

Table 3: Summary of Management Activities as Actual or Potential Sources of Stream Problems*

Timber Harvest			
	Inadequate SMZ		32%
		Excessive Blowdown	9%
		Excessive Stream Opening	3%
	Slash in Channel		20%
	Equipment in Channel		9%
	Skid Trail Erosion		5%
	Water Yield		1%
	Attributable Sediment to Channel		5%
Roads			
	Crossings		5%
	Inadequate SMZ		5%
	Culvert Maintenance		3%
	Surface Maintenance		9%
	Poor Road Closure		1%
	Road Headcut		1%
	Attributable Sediment		17%
Livestock			
	Bank Trampling		8%
	Attributable Sediment		8%
Miscellaneous Litter			5%
Fireline Erosion			1%

* Percentages based on the number of reaches (out of 75 managed reaches) where the surveyor could tie an activity directly to a stream problem or was confident that the activity would be a problem in the near future.

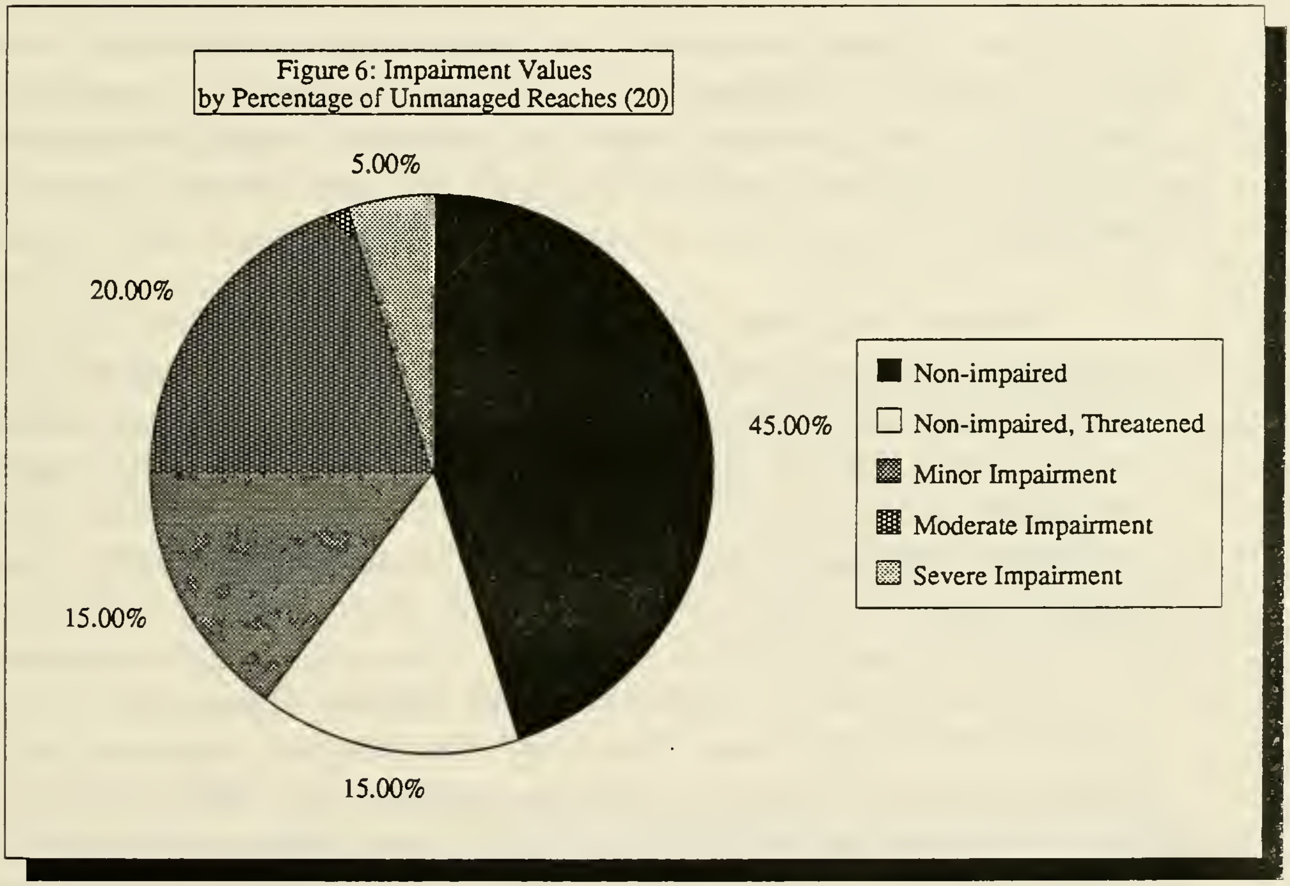


Figure 6: Impairment Values by Percentage of Unmanaged Reaches (20)

The assessment procedure attempts to incorporate portions of the evaluations conducted by all of the study modules. Unfortunately, results of the assessments did not correlate well with activity levels or with quantitative fisheries habitat evaluations. Since the assessment procedure is subjective and basically non-quantitative, we expect less accuracy or resolution in identifying subtle impairment such as that in the majority of the study streams.

Besides poor resolution of the assessment procedure, there are a number of possible reasons for poor correlations. The other studies relied on very few sample sites to evaluate activities in the drainage. The assessment procedure generally involved observations throughout the drainage and reach rankings were based on an average of conditions observed throughout the reach. There were several inaccessible stream reaches where assessments were based on one observation point on the lower end of the reach. In these cases assessments could well have misinterpreted upstream reach conditions.

Surveyor inconsistency or inaccuracy is another possible reason for poor correlation. Inaccuracy was avoided by selecting a surveyor with a good background in aquatic biology. The surveyor also received several days of training prior to conducting the assessments. Nevertheless, the assessment relies entirely on ocular observations which always leave room for inaccuracy. Surveyor inconsistency was limited since only one person conducted all assessments, however given the subjectivity of the procedure, inconsistency was certainly possible.

Of the "pristine" non-managed reaches assessed, 30 percent were rated as impaired. Two of these streams (Granite and Morrison), have management activity in the upper reaches. The impaired, non managed reaches were located downstream and generally exhibited very poor channel stability. These problems may or may not have been influenced by upstream management activity. The assessment procedure is meant to identify natural or hydrologic as well as NPS influences on stream condition. Admittedly, it's quite difficult to do this, however the reaches that have no management activity yet exhibit channel instability or occur in erosive geology may be naturally impaired and not fully supporting beneficial uses.

It can be argued that natural conditions should not be considered "impaired". Water pollution control laws certainly do not apply to natural impairment, however it is important to recognize that natural conditions may result in impairment to aquatic habitat. Although, it's unlikely that natural impairment can or ever will be addressed it should be an important consideration by land managers when evaluating the potential for future management activity.

CONCLUSIONS

Tree blowdown due to inadequate streamside management zones or harvest prescriptions, sediment from poor road maintenance, logging slash in the stream channel, and bank trampling by livestock were observed by the surveyor to be the primary causes of stream problems related to management practices. Although these activities negatively influenced stream conditions they where not always conclusively tied to impairment of beneficial uses.

In areas of relatively subtle NPS impairment and/or erosive geology such as many of the Flathead study streams, the resolution of the assessment procedure does not adequately separate natural factors from management influences.

Assessment categories eight through sixteen were generally not applicable to the study streams. Of the eight assessment categories (numbers 1 - 8) used to determine impairment values for this study, most were potentially influenced by, but not directly tied, to management activity.

In the Flathead study streams the assessment procedure either did not identify or underestimated impairment to fisheries. Many of the streams assessed as partially supporting (i.e. minor and moderate impairment) may in fact be in poorer condition than the assessments indicated.

The assessment procedure appears to adequately evaluate stream channel stability.

RECOMMENDATIONS

Since the assessment may underestimate the degree of impairment, streams that were assessed as severely impaired should be given priority for further action. The assessments designated five reaches as severely impaired (Ole II, Sinclair I, II, W. Fk. Swift III, and E. Fk. Swift II). With the exception of Ole Creek, which has no management activity, these areas should have priority status for further evaluation and potential mitigation.

The stream reach assessment procedure provides a good general overview of stream or watershed conditions, and should be capable of identifying severe or obvious stream problems. However, the procedure appears to underestimate subtle impairment to aquatic organisms. In areas of subtle impairment, such as the Flathead Basin, it is recommended that monitoring techniques which concentrate on biological organisms (habitat and/or population) be employed to provide the most reliable indicator of impairment to beneficial uses.

Although the stream reach assessment procedure lacks the resolution for identifying subtle stream impairments it has the potential to provide comprehensive stream/watershed information. The stream reach assessment or similar procedure is recommended to establish the need for quantative monitoring. A comprehensive stream/watershed assessment is also recommended to link isolated sample stations results into the "big picture". To improve the resolution of the stream reach assessment procedure in identifying subtle stream impairment and sources of impairment the following modifications are recommended:

1. Increase frequency of observation points, or walk longer sections of stream.
2. Concentrate observations in areas of management activity and especially in areas where activities have been evaluated (i.e. BMP audits).
3. Incorporate quantative methodology such as substrate score to improve resolution.
4. Incorporate a channel classification system such as that developed by Rosgen 1985, to predict expected conditions in a given reach.
5. Refine numerical ranking criteria to account for conditions influenced by geology, stream character or climactic.

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APPENDIX A. Nonpoint Source Stream Reach Assessment Form

NONPOINT SOURCE STREAM REACH ASSESSMENT
OVERVIEW

INTRODUCTION: NONPOINT SOURCE (NPS) POLLUTION IS HIGHLY DIFFUSE IN NATURE, UNLIKE POINT SOURCE POLLUTION WHICH CAN BE ATTRIBUTED TO A SINGLE POINT. NPS POLLUTION DISCHARGES OCCUR OVER DISPERSED PATHWAYS AND ARE GENERALLY ASSOCIATED WITH PRECIPITATION AND RUNOFF. NPS POLLUTION IS RELATED TO HUMAN LAND USES WHICH ARE CONTROLLABLE. BEST MANAGEMENT PRACTICES (BMP'S) ARE METHODS INCORPORATED WITH LAND USES THAT AVOID OR MINIMIZE IMPACTS TO WATER RESOURCES CAUSED BY NPS POLLUTION.

PURPOSE: THIS ASSESSMENT PROCEDURE IS DESIGNED FOR STATEWIDE USE TO PROVIDE AN INITIAL, STANDARDIZED METHOD TO IDENTIFY NONPOINT SOURCES, APPRAISE BMP APPLICATION AND EFFECTIVENESS AND ASSESS STREAM IMPAIRMENTS THAT HAVE RESULTED FROM NONPOINT SOURCE (NPS) POLLUTION. HYDROLOGIC FACTORS THAT CONTRIBUTE TO IMPAIRMENT OF THE STREAM WILL ALSO BE ASSESSED. THE WATER QUALITY BUREAU (WQB) WILL ASSIGN NUMERICAL RATINGS TO EACH ASSESSMENT PARAMETER WHICH WILL CATEGORIZE STREAMS RELATIVE TO DEGREE OF IMPAIRMENT. STREAMS CATEGORIZED AS SEVERELY IMPAIRED WILL RECEIVE EMPHASIS FOR FUTURE NPS POLLUTION MANAGEMENT. INFORMATION FROM THE ASSESSMENTS AND THE SUBSEQUENT RATINGS WILL PROVIDE A UNIFORM DATA BASE FOR EACH STREAM AND STREAM REACH. THIS DATA BASE WILL BE STORED IN THE MONTANA REACH TRACKING SYSTEM DEVELOPED BY THE WQB. INFORMATION IN THE REACH TRACKING SYSTEM WILL BE AVAILABLE TO INTERESTED INDIVIDUALS.

INSTRUCTIONS: THE ASSESSMENT PROCEDURE WILL BE LIMITED TO SECOND, THIRD AND FOURTH ORDER STREAMS[1]. THE DISTANCE OF EACH STREAM REACH ACTUALLY OBSERVED IS DEPENDENT ON FACTORS SUCH AS TIME OR ACCESSIBILITY. OBVIOUSLY THE BEST ASSESSMENT WOULD INVOLVE WALKING THE ENTIRE STREAM. REALISTICALLY THIS WILL NOT BE POSSIBLE IN MOST SITUATIONS AND IS NOT NECESSARY. AS A GENERAL GUIDE THE SURVEYOR SHOULD CHOOSE THE MOST ACCESSIBLE OBSERVATION POINTS THAT ALLOW ADEQUATE IDENTIFICATION OF IMPAIRMENTS THAT MAY BE OCCURRING IN A REACH. EXAMPLES WOULD BE AT THE STREAM MOUTH, ABOVE AND BELOW HUMAN ACTIVITIES AND BELOW TRIBUTARIES. THE SURVEYOR SHOULD WALK AT LEAST 100' OF THE STREAM AT EACH OBSERVATION POINT OR ENOUGH DISTANCE TO GET A REPRESENTATIVE PICTURE OF THE SITUATION AT THAT POINT. IF POSSIBLE, TRY TO INCORPORATE A RIFFLE, RUN AND POOL AT EACH OBSERVATION POINT.

EACH STREAM WILL CONSIST OF ONE OR MORE REACHES. ONE ASSESSMENT FORM WILL BE COMPLETED FOR EACH REACH. STREAM REACHES WILL BE DETERMINED BY THE SURVEYOR. EACH REACH SHOULD EXHIBIT FAIRLY HOMOGENOUS CONDITIONS. AS A GENERAL RULE REACH BREAKS OCCUR WHERE OBVIOUS CHANGES IN STREAM CONDITION ARE DETECTED. THE SURVEYOR SHOULD BE AWARE OF CHANGES SUCH AS LAND PRACTICES, FLOW, GRADIENT, VEGETATION, VALLEY TOPOGRAPHY AND SUBSTRATE.

CONSIDER THE ENTIRE REACH WHEN RATING PARAMETERS. AVOID CONCENTRATING ON SPECIFIC FEATURES UNLESS THEY ARE A MAJOR PROBLEM. PLEASE RATE ALL PARAMETERS ON THE FORM AND CHOOSE THE DESCRIPTION THAT IS MOST APPLICABLE. DO NOT LEAVE ANY RATING PARAMETERS BLANK. IN CASES WHERE RATING FACTORS DO NOT APPLY RECORD AS N/A; OR IF A PARAMETER RATING IS UNKNOWN RECORD AS SUCH.

TOPOGRAPHIC MAPS AT A MINIMUM AND AERIAL PHOTOS (IF POSSIBLE) SHOULD BE CONSULTED PRIOR TO THE ASSESSMENT TO PICK OUT PROMINENT FEATURES IN THE WATERSHED AND TO SELECT OBSERVATION POINTS. MAPS WITH IDENTIFICATION OF OBSERVATION POINTS, REACH BREAKS, AND ANY IMPORTANT FEATURES SHOULD BE TURNED IN WITH ASSESSMENT FORMS.

ANY OUTSTANDING FEATURES OBSERVED I.E. GROSS SEDIMENT SOURCES, FISH BARRIERS, POINT SOURCE DISCHARGES, ETC. SHOULD BE PHOTOGRAPHED (IF POSSIBLE) AND LABELED ON THE MAP TO BE TURNED IN WITH THE ASSESSMENT FORM.

EQUIPMENT: AT MINIMUM YOU WILL NEED FIELD FORMS AND MAPS TO DO ASSESSMENTS. IT IS SUGGESTED THAT THE SURVEYOR INCLUDE A THERMOMETER IF IRRIGATION RETURNS ARE EXPECTED TO BE ENCOUNTERED, AND A CAMERA TO PHOTOGRAPH ANY NOTABLE FEATURES ALONG THE STREAM.

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[1] FOR DEFINITION OF STREAM ORDER SEE PAGE 1 OF ASSESSMENT FORM UNDER GENERAL INFORMATION.

NONPOINT SOURCE STREAM REACH ASSESSMENT
MONTANA WATER QUALITY BUREAU
FIELD REPORT FORM

GENERAL INFORMATION

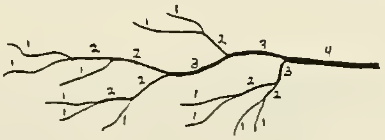
STREAM NAME______________________ RIVER BASIN[1]__________________________ COUNTY(S)____________________
ASSESSED BY (NAME)________________DEPT./AGENCY/OTHER______________________ DATE ASSESSED_______________
REACH LEGAL DESCRIPTION T./R./S. 1/4SEC. BEGINNING __________________________ END______________________________
REACH NUMBER OR LETTER (ASSIGNED BY SURVEYOR) ______________
PLEASE DESCRIBE ANY PROMINENT LANDMARKS THAT MAY DELINEATE REACH BREAKS. ____
____

DELINIATE ALL REACH BOUNDARIES AND OBSERVATION POINTS ON MAP/S AND ATTACH TO ASSESSMENT FORMS.

LAST RAINFALL DATE AND AMOUNT OR INTENSITY IF KNOWN____________________ **WATER TEMPERATURE** _____AT______AM/PM
FLOW STAGE (RELATIVE TO BANK FULL 100%) ___FLOOD,100+% ___HIGH,75% ___MODERATE,50% ___LOW,<25% ___NO WATER
STREAM DESCRIPTION: CHECK THE ITEM IN EACH COLUMN THAT BEST FITS

GRADIENT	VALLEY SHAPE	CHANNEL PATTERN	CHANNEL EROSION	STREAM TYPE
___>3%	___"V" SHAPED	___SINGLE, STRAIGHT	___VERTICAL EROSION DOMINATES	___ MOUNTAIN
___1-3%	___"U" SHAPED	___SINGLE, SINUOUS	___VERTICAL & HORIZONTAL COMMON	___ TRANSITIONAL
___<1%	___ FLAT	___BRAIDED, STRAIGHT	___HORIZONTAL EROSION DOMINATES	___ PRAIRIE
		___BRAIDED, SINUOUS		

FISHERIES: CHECK THE ITEM THAT BEST FITS
____COLD WATER (TROUT SPECIES ONLY) ____WARM/COOL WATER DOMINATED BY SPECIES SUCH AS BASS, CATFISH, SUNFISH, PIKE, WALLEYE.
____COMBINATION OF COLD/COOL/WARM WATER FISHERIES ALL WELL REPRESENTED
STREAM ORDER: ____FIRST ____SECOND ____THIRD ____FORTH
YOU SHOULD USE A TOPO. MAP TO DETERMINE THIS.
TWO OR MORE FIRST ORDER STREAMS BECOME A SECOND ORDER.
TWO OR MORE SECOND ORDER STREAMS BECOME A THIRD ORDER.
TWO OR MORE THIRD ORDER STREAMS BECOME A FOURTH ORDER.
ETC...



FLOW REGIME:
____EPHEMERAL, FLOWS ONLY DURING RAINSTORMS OR PEAK SPRING RUNOFF.
____INTERMITTENT, SEASONAL FLOWS DURING WET WEATHER, SPRING RUNOFF OR FLOWS YEAR ROUND EXCEPT FOR POINTS OF SUBSURFACE FLOW.
____PERENNIAL, FLOWS YEAR ROUND, LITTLE OR NO SUBSURFACE FLOW.

* * *

ADDITIONAL INFORMATION - COMPLETED BY FIELD PERSONNEL IF KNOWN, OTHERWISE COMPLETED BY WQB.

MT WATER BODY ID #:____________COUNTY FLAG:________________STREAM CLASSIFICATION: A, B OR C________EPA REACH #__________
BENEFICIAL USES: DRINKING WATER____, STOCK WATER____, FISHERIES____, OTHER______________________
IMPAIRMENT SEVERITY: ____MINOR OR NO INTERFERENCE ____THREATENED, NO INTERFERENCE BUT DOWNWARD TREND ____MODERATE, SOME INTERFERENCE BUT USE NOT PRECLUDED ____SEVERE, USE PRECLUDED
WERE WATER SAMPLES OBTAINED? YES, NO. IF YES, WHAT ANALYSES WILL BE PERFORMED? WHAT PRESERVATIVES WERE USED?__________________
GIVE RESULTS, IF ANY____
____
____

* * *

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[1] RIVER THAT THE STREAM BEING ASSESSED IS A TRIBUTARY TO.

PLEASE CHECK THE MOST APPROPRIATE ANSWER FOR EACH PARAMETER. MAKE SURE TO ELABORATE WHEN ASK OR WHENEVER NECESSARY TO CLARIFY YOUR ANSWER.

GENERAL ASSESSMENT PARAMETERS

1. NATURAL EROSION: (NATEROS) NATURAL EROSION OCCURRING OUTSIDE OF HIGH WATER MARK BUT WITHIN 200' OF THE STREAM. DO NOT BASE THIS RATING ON HUMAN OR STREAM CHANNEL/BANK EROSION. CONSIDER EROSIVE FEATURES SUCH AS LAND SLUMPS/SLIDES, GULLIES/RILLS/SHEETS ETC.
EROSION EVIDENT: ____NONE OR MINOR ____SOME ____MODERATE ____SEVERE **[PLEASE ELABORATE]**

2. LAND USE: (LAND) HUMAN ACTIVITIES WITHIN THE WATERSHED THAT HAVE THE POTENTIAL TO CREATE NPS POLLUTION.
CHECK ONE OR MORE ITEMS TO DESCRIBE DISTANCE FROM STREAM CHANNEL THAT ACTIVITIES HAVE OCCURRED:
____NO ACTIVITIES HAVE OCCURRED ____GREATER THAN 200' ____50-200' ____LESS THAN 50'

LIST PREDOMINANT ACTIVITIES AND HOW RECENT THE ACTIVITIES ARE (<5, 5-10, >10 YEARS) FOR EACH DISTANCE CATEGORY.
> 200'

50 - 200'

< 50'

3. NONPOINT SOURCE POLLUTION: (NPSP) CONSIDER ONLY THE POLLUTION THAT APPEARS ATTRIBUTABLE TO HUMAN ACTIVITIES. **[PLEASE ELABORATE]**
POLLUTION EVIDENT: ____NONE ____SOME, THOUGH NOT COMMON ____MODERATE ____SEVERE
(EXAMPLES MIGHT BE SEDIMENT DEPOSITION IN ROAD DITCHES OR BELOW EPHEMERAL TRIBS., MANURE, IRON PRECIPITATES, TRASH ETC.)

4. BANK STABILITY: (BANKS) CONSIDER ALL OBSERVED STREAM BANK EROSION. **[PLEASE ELABORATE]**
____ NONE OR MINOR EVIDENCE OF BANK EROSION OR FAILURE (<10% OF TOTAL).
____ MODERATE INSTABILITY, MODERATE AREAS OF BANK EROSION OR BANK FAILURE (10-20% OF TOTAL).
____ SUBSTANTIAL INSTABILITY, FREQUENT AREAS OF BANK EROSION OR FAILURE (21-40% OF TOTAL).
____ UNSTABLE, SEVERE BANK EROSION AND FAILURE (>40% OF TOTAL). EROSION OCCURS ON STRAIGHT SECTIONS AND BENDS.
* AVERAGE SIZE OF ERODED BANKS; HEIGHT ____<1' ____1-3' ____>3' LENGTH ____<5' ____5-20' ____>20'
* ARE BANKS ____VERTICALLY EROSIONAL ____UNDERCUT ____SLUMPS OTHER (DESCRIBE)____________________
* DOES THE EROSION APPEAR TO PRIMARILY BE THE RESULT OF HUMAN ACTIVITY ? ___YES ___NO

5. SUBSTRATE COMPOSITION: (SUBCOMP) CONSIDER ONLY THE TOP (VISIBLE) LAYER OF SUBSTRATE MATERIAL.
RIFFLE = RELATIVELY SHALLOW, FAST MOVING, WITH BROKEN OR TURBULENT SURFACE, RUN = MODERATE FLOW, WATER SURFACE NOT TURBULENT TO THE POINT OF BEING BROKEN; POOL = SLOW FLOW, SMOOTH SURFACE, GENERALLY DEEPER THAN A RUN OR RIFFLE.

	RIFFLE	RUN	POOL
* LIST THE DOMINANT SUBSTRATE MATERIAL FOR EACH FEATURE: FINES <1/4"DIA., GRAVEL 1/4"-3"DIA., COBBLE/RUBBLE 3"-12"DIA., BOULDERS/BEDROCK >12"DIA.	________	________	________
* ESTIMATE PERCENTAGE OF FINE MATERIAL (<1/4") FOR EACH FEATURE: (25% increments)	________	________	________
* INDICATE THE AREA OF THE CHANNEL WHERE THE MAJORITY OF FINE MATERIAL IS DEPOSITED: EDGE, MIDDLE, DOWNSTREAM OF ROCKS/LOGS, THROUGHOUT	________	________	________

* IS SUBSTRATE MATERIAL CEMENTED (SURROUNDED BY TIGHTLY PACKED FINES)? ____ YES, ____ NO.

MISC. NOTES:

STREAM NAME AND COUNTY________________________________ DATE__________ SURVEYOR______________________

GENERAL ASSESSMENT PARAMETERS CONTINUED...

6. CHANNEL STABILITY: (CHANSTAB) CONSIDER SHIFTS IN SUBSTRATE MATERIAL (I.E. SCOURING, DEPOSITION, POOL FILLING).

SCOURING AND DEPOSITION

___ NONE OR MINOR, BARS STABLE AND WELL VEGETATED (<5% AFFECTED BY EITHER PROCESS).
___ SOME SCOUR AT CONSTRICTIONS OR STEEP GRADES, AND/OR POINT BAR ENLARGEMENT BY COURSE GRAVEL. (5-30% AFFECTED).
___ MODERATE SCOUR AND/OR DEPOSITION, POINT BARS ENLARGING BY GRAVEL AND SAND AND SOME NEW BARS FORMING. (31-50% AFFECTED).
___ SEVERE SCOUR AND/OR DEPOSITION OCCURS IN MOST AREAS OF THE STREAM. NEW BAR DEVELOPEMENT BY FINE MATERIAL IS COMMON. (>50% OF THE CHANNEL IS IN THE STATE OF FLUCTUATION)
[NOTE: "NEW" DEPOSITINAL MATERIAL SHOULD BE CLEAN (LIGHTER COLORED), LOOSE AND UNVEGETATED]

POOL DEVELOPMENT

___ POOLS COMMON AND/OR WELL DEVELOPED.
___ MINOR POOL FILLING, MOSTLY BY SILT.
___ POOL SIZE DECREASING DUE TO FILLING.
___ POOLS SEVERELY REDUCED OR LACKING DUE TO FILLING.

CHANNEL CAPACITY

___ CHANNEL CONTAINS PEAK FLOWS PLUS MORE IF NECESSARY (W/D <7)
___ CHANNEL CONTAINS MOST PEEK FLOWS (W/D = 8 TO 15)
___ CHANNEL BARELY CONTAINS PEAK FLOWS (W/D = 16 TO 25)
___ CHANNEL CAPACITY GENERALLY INADEQUATE FOR PEAK FLOW. OVERBANK FLOWS COMMON (W/D >25)

7. STREAMSIDE VEGETATION: (STRVEG) CONSIDER ALL VEGETATION WITHIN 100' OF ACTIVE (SCOURED) CHANNEL. BRIEFLY DESCRIBE THE STREAMSIDE VEG. COMMUNITY (I.E. DOMINANT SPP., AGE, WIDTH, ETC.)

VEGETATIVE BANK STABILITY: ABILITY OF BANK VEG. TO RESIST EROS. ____GOOD ____FAIR ____POOR

PERCENT BARE GROUND: AMOUNT OF BARE GROUND (EXPOSED MINERAL SOIL) W/IN VEG.ZONE ___<15% ____15-30% ____31-45% ____>45%

AVERAGE WIDTH OF VEGETATIVE ZONE: ____>100' ____76-100' ____51-75' ____25-50' ____<25'
ESTIMATE MINIMUM WIDTH ______' AND MAXIMUM WIDTH ______'

USE AND/OR DAMAGE: CONSIDER NATURAL (I.E. WINDTHROW, DEAD TREES ETC.) OR HUMAN FACTORS (I.E. GRAZING, LOGGING ETC). PLEASE ELABORATE* BY DESCRIBING TYPE OF USE OR DAMAGE OBSERVED.
____NONE OR MINOR ____MODERATE ____SUBSTANTIAL ____SEVERE

STREAM SHADING: CONSIDER HOW MUCH OF THE STREAM IS SHADED BY BANK VEGETATION.
____>75% ____51-75% ____25-50% ____<25%

SEDIMENT FILTERING CAPACITY CONSIDER FACTORS SUCH AS SLOPE AND SEDIMENT SOURCES
____GOOD ____FAIR ____POOR

8. CHANNEL MODIFIERS: (CHANMOF) CONSIDER NATURAL AND ARTIFICIAL MATERIALS AND/OR STRUCTURES (IE.ANY MATERIAL OR STRUCTURE THAT HAS FALLEN IN OR BEEN PLACED IN THE STREAM CHANNEL). EXAMPLES OF MODIFIERS ARE BRIDGES, CULVERTS, DEBRIS JAMS, BEAVER DAMS, CAR BODIES, RIP-RAP ETC... **[PLEASE ELABORATE]**

____STRUCTURES/MATERIALS STABLE AND IMPROVING STREAM CONDITION (EX. SED. TRAP, FISH HABITAT, BANK STABILITY.) OR OTHERWISE NOT CAUSING FISH PASSAGE OR STABILITY PROBLEMS.
____STRUCTURES/MATERIALS GENERALLY STABLE EXCEPT DURING FLOODS; RELATED STABILITY PROBLEMS MINOR.
____STRUCTURES/MATERIALS HAVE GOOD POTENTIAL TO BE MOVED WITH HIGH TO MODERATE FLOWS. THESE FEATURES MAY RELEASE SEDIMENT INTO THE SYSTEM AND/OR CAUSE BANK OR CHANNEL EROSION.
____STRUCTURES/MATERIALS UNSTABLE AND/OR CAUSING SEVERE BANK OR CHANNEL EROSION.

DESCRIBE THE MATERIALS OR STRUCTURES THAT MAY BE MODIFYING THE CHANNEL.

DESCRIBE ANY POSITIVE CONTRIBUTIONS THAT MODIFIERS ARE MAKING TO THE STREAM (EX. FISH COVER, STABLE SED. TRAPS, BANK STABILIZATION ETC.)

DESCRIBE ANY NEGATIVE CONTRIBUTIONS THAT MODIFIERS ARE MAKING TO THE STREAM (EX.BANK/CHANNEL EROSION, FISH BARRIERS, UNSTABLE SEDIMENT TRAPS, ETC)

IMPAIRMENT INDICATORS

(IF IMPAIRMENTS ARE EVIDENT AND CONCENTRATED IN A SPECIFIC AREA, PLEASE NOTE LOCATIONS ON MAP)

TURBIDITY
CLEAR___ SLIGHTLY OFF COLOR___ CLOUDY___ OPAQUE___ COLOR:_____________

WATER SURFACE OILS
NONE____, SLIGHT____, MODERATE____, SEVERE____
SLICK___, SHEEN___, FLECKS____, OTHER_______________ SOURCE, IF KNOWN _____________________

PRECIPITATES OTHER THAN SEDIMENT ON CHANNEL BOTTOM
NONE____, SLIGHT____, MODERATE____, PROFUSE____ COLOR:__________________

SALINIZATION
___ NONE EVIDENT:
___ SOME: EVIDENCE OF SALINITY IS PRESENT IN THE WATERSHED HOWEVER NO SALT CRUSTS WERE OBSERVED WITHIN 100' OF THE STREAM.
___ MODERATE: SALT CRUSTS PRESENT <100' FROM THE STREAM. MAY BE MINOR EVIDENCE OF SALTS ON THE STREAM BANK. PLANT DIVERSITY AND ABUNDANCE MAY BE REDUCED OR DOMINATED BY SALT TOLERANT SPECIES (I.E. SALTGRASS, RABBIT BRUSH, FOXTAIL BARLEY, W. WHEATGRASS).
___ SEVERE: SALT CRUSTS COMMON WITHIN 100' OF THE STREAM OR ON STREAM BANKS. VEGETATION MAY BE SEVERELY REDUCED DUE TO SALT. SALT DEPOSITS MAY BE EVIDENT ON STREAM ROCKS.

FOREIGN DEBRIS: CONSIDER MATERIALS SUCH AS GARBAGE, MANURE, LOGGING SLASH, ETC. AND POSITION RELATIVE TO STREAM CHANNEL.

LOCATION OF DEBRIS RELATIVE TO DISTANCE FROM CHANNEL	AMOUNT (N = NONE, (P = PRESENT, C= COMMON, E = EXCESSIVE)	POTENTIAL TO REACH CHANNEL (L = LOW, M = MOD., H = HIGH)
___ >200' FROM STREAM CHANNEL.	____________	____________
___ 50-200' OF STREAM CHANNEL.	____________	____________
___ < 50' FROM THE STREAM CHANNEL.	____________	____________
___ MATERIAL PRESENT ON BANKS AND IN THE STREAM CHANNEL.	____________	____________

* DESCRIBE THE MATERIAL OBSERVED.

WATER ODOR
NONE___, SLIGHT___, MODERATE___, STRONG___
SEWAGE___, PETROLEUM___, CHEMICAL___, NATURAL___, OTHER_________

DEWATERING: AS A RESULT OF IRRIGATION OR NATURAL FACTORS SUCH AS SUBSURFACE FLOWS.
___ NO APPARENT WATER LOSS (IRRIGATION MAY BE SUPPLEMENTING BASE FLOW)
___ WATER LOSS NOTICEABLE, HOWEVER FLOWS ARE ADEQUATE TO SUPPORT AQUATIC ORGANISMS.
___ FLOW WILL SUPPORT AQUATIC ORGANISMS, THOUGH HABITAT, ESPECIALLY RIFFLES IS DRASTICALLY REDUCED.
___ CHANNEL MAY BE DRY OR FLOW LOW ENOUGH TO PRECLUDE OR SEVERELY IMPAIR AQUATIC ORGANISMS.
* SUSPECTED CAUSES: NATURAL_______________________HUMAN-CAUSED______________________
* WERE IRRIGATION RETURN FLOWS OBSERVED? YES____ NO____ IF YES, RATE TURBIDITY H__ M__ L__
* STREAM TEMPERATURE? ABOVE RETURN_____ BELOW RETURN_____

AQUATIC ORGANISMS

FISHERIES
* WERE FISH OBSERVED? YES____ NO____ IF YES, ____PRESENT, ____COMMON, ____ABUNDANT. SPECIES, IF KNOWN_____________________
* DID FISH EXHIBIT ABNORMAL BEHAVIOR? YES____ NO____
* WERE ANY FISH BARRIERS (IMPENETRABLE BLOCKAGES >3' HEIGHT) OBSERVED? YES____ NO____ BE SURE AND LOCATE BARRIERS ON MAP.

AQUATIC PLANT GROWTH
ABSENT____ PRESENT/NOT COMMON____ COMMON____ ABUNDANT____
DOES PLANT GROWTH APPEAR NORMAL GIVEN THE SEASON AND NATURAL STREAM CONDITIONS? YES____ NO____
IS ALGAE FILAMENTOUS? YES_____ NO_____
WHAT COLOR IS THE ALGAE? _______________

PLEASE ANSWER THE FOLLOWING QUESTIONS
- WAS WATER SURFACE FOAM >3" HIGH OBSERVED? YES____ NO____

- HAS CHANNEL BEEN ARTIFICIALLY MODIFIED? CONSIDER ONLY PRACTICES SUCH AS DREDGING, STRAIGHTENING, AND CHANNELIZATION.
  YES___ NO___
  IF YES, INDICATE THE TYPE OF MODIFICATION_________________ AND APPROXIMATELY HOW RECENT?
  <5YRS._____ 5-10YRS._____ >10YRS_____
- HAVE THE MODIFIED PORTIONS OF THE CHANNEL STABILIZED? YES____ NO____.

- WERE POINT SOURCES OBSERVED? YES____ NO____ IF YES, PLEASE DESCRIBE AND RECORD LOCATION ON MAP

STREAM NAME AND COUNTY________________________ DATE__________ SURVEYOR____________________

BEST MANAGEMENT PRACTICES (BMP'S) AND LAND USE CHARACTERISTICS (200' EITHER SIDE OF STREAM)

PLEASE RATE THE FOLLOWING TO THE BEST OF YOUR KNOWLEDGE. GENERALLY CONSIDER BMP'S TO BE ANY MEASURES INCORPORATED WITH LAND USE ACTIVITIES THAT MAY HELP PROTECT WATER RESOURCES FROM NPS POLLUTION.

	EST % OF TOTAL AREA RELATIVE TO DISTANCE FROM STREAM		HAVE BMP'S BEEN APPLIED Y/N*		RATE EFFECTIVENESS OF BMP'S*	
LAND USES	0-50'	50-200'	0-50	50-200'	0-50'	50-200'
NON-IRRIGATED CROP						
IRRIGATED CROP						
GRAZING						
FEEDLOTS						
TIMBER HARVEST						
ROADS (% IS OPTIONAL)						
SURFACE MINING						
SUBSURFACE MINING						
URBAN						
OTHER________						
OTHER________						

*APPLICATION OF BMP'S

Y (YES) THE MAJORITY OF EACH PARTICULAR LAND USE IN THE REACH HAS BMP'S APPLIED.

N (NO) THE MAJORITY OF EACH PARTICULAR LAND USE IN THE REACH DOES NOT HAVE BMP'S APPLIED.

* BMP EFFECTIVENESS

1 MORE THAN ADEQUATE PROTECTION
2 ADEQUATE PROTECTION
3 MINOR AND/OR SHORT TERM IMPACTS
4 MAJOR AND/OR LONG TERM IMPACTS

PLEASE ELABORATE:

WHICH BMP'S WERE OBSERVED?

WHAT BMP'S NEED TO BE APPLIED TO IMPROVE THE SITUATION?

WHAT IMPACTS WERE OBSERVED? WHAT IS THE POTENTIAL FOR CORRECTION? G=GOOD, F=FAIR, P=POOR

APPENDIX B. Description of NPS Assessment Categories

APPENDIX B.

1. **Natural Erosion:** Considers erosion occurring outside the high water mark but within 200' of the stream. This category evaluates factors such as land slumps/slides, gully/rill/sheet erosion, and avalanche chutes.
2. **Land Use:** Considers human activities within a drainage. Land use is ranked according to the distance the activity is occurring from the stream channel. Obviously the closer an activity is to the channel the higher the risk it has of creating NPSP. Space is provided to list the activities observed at different intervals from the stream channel and estimate how recent the activities are.
3. **Nonpoint Source Pollution:** This category evaluates obvious pollutants that are attributable to human activity. The observer describes evidence of NPSP (i.e. road erosion, garbage, manure, etc.) and indicates the relative amount present.
4. **Bank Stability:** This category is rated by estimating the percentage of eroding banks relative to the total observed. The size and suspected cause of the erosion (i.e. stream flow, or human) also influences the rating. It is often impossible to determine the specific cause of bank erosion, therefore only obvious human-caused problems such as physical damage from livestock or machinery are recorded as such.
5. **Substrate Composition:** This category considers only the top or visible layer of substrate material. For each major channel component (riffles, runs and pools) the following information is recorded: dominant substrate material, percentage of sediment less than 1/4" diameter by 25% categories (i.e. >25%, 25 - 50%, etc.), predominant area/s of sediment deposition, and if the substrate is cemented by fines. This is one of the most difficult categories for the surveyor to subjectively rate, however it is also one of the more important in terms of aquatic habitat condition.
6. **Channel Stability:** Channel Stability is evaluated by considering 1) relative percentage of the channel affected by scour and/or deposition, 2) depositional particle size, 3) pool development, and 4) channel ability to contain peak flows. Stream channel instability can negatively affect aquatic habitat and indicate adverse flow condition related to upstream management activity such as channel modification or vegetation removal. Natural hydrologic conditions can also create highly unstable channel conditions. It is often difficult to determine the cause of stream channel instability, but this category may provide some insight into cause and effect of excessive sediment deposition or channel degradation.

7. **Streamside Vegetation:** This category considers the streamside zone 100' either side of the stream and is divided into six sub-categories. These sub-categories are: A) **Vegetative bank stability, B) Percent bare ground, C) Average width of vegetative zone, D) Vegetational use or damage, E) Stream shading (percent) by vegetation**, and F) **Sediment filtering capacity.** This category is designed to evaluate the influence of management activity on the riparian zone. The ability of the streamside vegetation to resist floods and function as a buffer to management activity is also evaluated.
8. **Channel Modifiers:** This category considers any material in the channel that may be influencing channel conditions relative to stability or habitat. Examples of modifiers could be bridges, culverts, debris jams, culverts, car bodies, etc.. This category is evaluated by considering the relative positive and/or negative contributions of channel modifiers. Positive contributions could be stable sediment traps, pool development, or fish cover. Negative contributions of channel modifiers might be stream bank erosion from flow deflection, channel erosion, unstable sediment traps, or fish barriers.
9. **Turbidity:** Relative turbidity levels, clear to opaque are defined. Excessive turbidity may indicate erosion problems associated with management activity. It is largely dependent on runoff events and may be significantly influenced by geology. Ratings are weighted and based on fisheries type (cold or warm water). This category is given the most weight for cold water fisheries streams at flow regimes other than peaks. Cold water fish such as trout may be negatively influence by highly turbid conditions which may hinder sight feeding and clog gills. Highly turbid flow in a trout stream after a rainstorm is perceived as an impairment indicator. Conversely, a typical warm water stream in eastern Montana may always be highly turbid and contain fish populations adapted to such conditions. Therefore turbidity is not considered a significant impairment indicator for streams supporting warm water fisheries.
10. **Water Surface Oils:** This category is rated from none to severe and asks the surveyor to categorize surface oil as a "slick", "sheen", "flecks" or other and describe the source if known. It is recognized that natural surface oil can occur, however this category is meant to identify impairment directly related petroleum pollution.
11. **Precipitates (Other Than Sediment) On The Channel Bottom:**
    Evaluation of precipitates is based on the relative amount observed (none to profuse). Examples of precipitates could be iron oxides related to acid mine drainage, and heavy organics or fungal growth related to illegal dumping or discharges.

12. **Salinization:** Salts can render surface water unsuitable for any beneficial uses. This category is applicable to salt prone sedimentary geologies and generally not applicable to the Flathead Basin. In any event, this category rates the relative abundance of salts crusts and distance they occur from the stream channel. Occurrence of salt tolerant plant species is also noted.

13. **Foreign Debris:** Any foreign debris that results from human activity. Examples could be manure, logging slash, dirt fill, garbage, etc.. A risk rating is assigned to this category that is based primarily on the amount of material and the distance the material is from the stream channel.

14. **Water Odor:** Self explanatory and rated by strength of odor (none to strong) and type of odor such as sewage, petroleum, or chemical.

15. **Dewatering:** This category is rated by the degree of dewatering (none to severe) relative to aquatic habitat (riffles). The suspected cause of dewatering (natural vs. human caused, such as irrigation withdrawals) also influences the rating. Human influenced dewatering is weighted highest as an impairment indicator for this category.

16A. **Fisheries:** This category is evaluated by the abundance of fish observed (none to abundant) and any abnormal behavior indicative of stressors such as chemical pollutants or low dissolved oxygen.

16B. **Aquatic Plant Growth:** This category is also rated by relative abundance of plant growth, primarily algae. Abundant algal growth, particularly filamentous algae, may indicate excessive nutrients or low dissolved oxygen in the water.

APPENDIX C. NPS Assessment Ranking Form

NUMERICAL RANKING CRITERIA
NONPOINT SOURCE STREAM REACH ASSESSMENT

FOR THE PURPOSE OF THIS ASSESSMENT PROCEDURE, IMPAIRMENT IS DEFINED AS THE DEGREE TO WHICH A STREAM REACH WILL SUPPORT DESIGNATED BENEFICIAL USES. IMPAIRMENTS ARE CATEGORIZED AS; NON SUPPORTING (SEVERE IMPAIRMENT), PARTIALLY SUPPORTING (MODERATE OR MINOR IMPAIRMENT), FULL SUPPORT (THREATENED OR NO IMPAIRMENT). IMPAIRMENT SEVERITY OF AN ASSESSED STREAM REACH WILL BE BASED ON A SUMMARY OF THE FOLLOWING NUMERICAL VALUES FOR EACH PARAMETER DIVIDED BY THE TOTAL POSSIBLE FOR ALL (RATED) PARAMETERS.

1. **NATURAL EROSION** [RANGE = 4 - 1]
   4 NONE OR MINOR 3 SOME 2 MODERATE 1 SEVERE

2. **LAND USE** [RANGE = 4 - 1]
   4 NO ACTIVITIES 3 >200' 2 50-200' 1 <50'

3. **NONPOINT SOURCE POLLUTION** [RANGE = 8 - 2]
   8 NONE 6 SOME, THOUGH NOT COMMON 4 MODERATE 2 SEVERE

4. **BANK STABILITY** [RANGE = 12 - 0]
   12 NONE OR MINOR <10% 9 MODERATE INSTABILITY 6 SUBSTANTIAL INSTABILITY 3 SEVERE INSTABILITY
   NOTE: IF AVERAGE HEIGHT IS >3' AND IF AVERAGE LENGTH >20' **SUBTRACT 1.**
   NOTE: IF EROSION APPEARS TO BE PRIMARILY HUMAN RELATED **SUBTRACT 2.**
   EXAMPLE: GENERAL RATING IS 9, AND ERODING BANKS HAVE AN AVERAGE HEIGHT OF >3' AND LENGTH OF >20', SUBTRACT 1; BANK EROSION IS PRIMARILY HUMAN CAUSED, SUBTRACT 2. (9 - 1 - 2 = OVERALL RATING OF 6).

5. **SUBSTRATE COMPOSITION** [RANGE = 30 - 0]

   EACH FEATURE (RIFFLE, RUN, POOL) AS APPLICABLE WILL BE NUMERICALLY RANKED. EACH FEATURE WILL START WITH A VALUE OF (10). TO FIGURE AN OVERALL VALUE FOR EACH FEATURE THE FOLLOWING **SUBTRACTIONS** WILL BE MADE FOR "DOMINANT SUBSTRATE" ON ALL STREAMS AND FOR "PERCENTAGE OF FINES" AND CEMENTATION ON STREAMS WITH COLD WATER FISHERIES ONLY. THE "AREA OF FINE SEDIMENT DEPOSITION" WILL NOT FIGURE INTO THE RANKING.

	RIFFLE (10)	RUN (10)	POOL (10)
DOMINANT SUBSTRATE: FINES (<1/4") **SUBTRACT 4**, GRAVEL, COBBLE/RUBBLE AND BOULDER/BEDROCK ALL = 0. –	____	____	____
SUBTRACT THE FOLLOWING ONLY IF THIS IS A COLD WATER FISHERIES.			
PERCENTAGE OF FINES: >25% **SUBTRACT 1**, 25-50% **SUBTRACT 2**, 50-75% **SUBTRACT 3**, >75% **SUBTRACT 4**. –	____	____	____
IS SUBSTRATE MATERIAL CEMENTED: YES **SUBTRACT 2**, NO = 0 –	____	____	____

EXAMPLE: THIS IS A COLD WATER FISHERY; DOMINANT SUBSTRATE IS COBBLE (SUBTRACT 0); PERCENTAGE OF FINES IS ESTIMATED AT 40%, (SUBTRACT 2) AND THE SUBSTRATE IS GENERALLY CEMENTED (SUBTRACT 2). CALCULATION FOR OVERALL VALUE 10 - 0 - 2 - 2 = 6.

6. **CHANNEL STABILITY** [RANGE = 24 - 6]
   SCOUR AND DEPOSITION: 8 NONE OR MINOR, 6 SOME, 4 MODERATE, 2 SEVERE.
   POOL DEVELOPMENT: 8 POOLS COMMON/WELL DEVP., 6 MINOR POOL FILLING, 4 DECREASING POOL SIZE, 2 POOLS SEVERELY REDUCE REDUCED.
   CHANNEL BRAIDING: 8 NONE, 6 PRESENT/NOT COMMON, 4 COMMON / STABILITY REDUCED, 2 BRAIDING DOMINATES / STABILITY POOR.

7. **STREAMSIDE VEGETATION** [RANGE = 19 - 5]

   PERCENT BARE GROUND: 4 <15%, 3 15-30%, 2 31-45%, 1 >45%
   AVERAGE WIDTH OF VEG. ZONE: 4 >75', 3 51-75', 2 25-50', 1 <25'
   USE OR DAMAGE: 4 NONE OR MINOR, 3 MODERATE, 2 SUBSTANTIAL, 1 SEVERE
   STREAM SHADING: 4 >75%, 3 51-75%, 2 25-50%, 1 <25%
   SEDIMENT FILTERING CAPACITY: 3 GOOD, 2 FAIR, 1 POOR

8. **CHANNEL MODIFIERS** [RANGE = 4 - 1]
   4 STRUCTURES STABLE AND IMPROVING STREAM CONDITION.
   3 STRUCTURES GENERALLY STABLE EXCEPT DURING FLOODS; RELATED STABILITY PROBLEMS MINOR.
   2 STRUCTURES HAVE GOOD POTENTIAL TO BE MOVED WITH HIGH TO MODERATE FLOWS; THESE FEATURES MAY RELEASE SEDIMENT OR CAUSE BANK EROS.
   1 STRUCTURES UNSTABLE AND/OR CAUSING SEVERE BANK OR CHANNEL EROSION.

IMPAIRMENT INDICATORS

1. **TURBIDITY** [RANGE WARM WATER 8 - 2, COLD WATER 8 - 1]
RATE COLD AND WARM WATER FISHERIES SEPARATE.
WARM WATER: 8 CLEAR, 6 SLIGHTLY OFF COLOR, 4 CLOUDY, 2 OPAQUE
COLD WATER: 8 CLEAR, 3 SLIGHTLY OFF COLOR, 2 CLOUDY, 1 OPAQUE

2. **WARM SURFACE OILS** [RANGE = 4 - 1]
4 NONE, 3 SLIGHT, 2 MODERATE, 1 SEVERE

3. **PRECIPITATES OTHER THAN SEDIMENT** [RANGE = 4 - 1]
4 NONE, 3 SLIGHT, 2 MODERATE, 1 PROFUSE

4. **SALINIZATION** [RANGE = 8 - 2]
8 NONE, 6 SOME, 4 MODERATE, 2 SEVERE

5. **FOREIGN DEBRIS** [RANGE = 8 TO -1]
IF MATERIAL IS PRESENT "ON BANKS OR IN THE CHANNEL" OR "WITHIN 50' OF THE CHANNEL" SUBTRACT 1 FOR "COMMON" AND 2 FOR "EXCESSIVE" UNDER AMOUNT. SUBTRACT 1 FOR "MODERATE AND 2 FOR "HIGH" UNDER POTENTIAL TO REACH STREAM.

DISTANCE FROM CHANNEL	AMOUNT (P= PRESENT, C= COMMON, E=EXCESSIVE)	POTENTIAL TO REACH CHANNEL (L= LOW, M= MODERATE, H= HIGH)
8 >200' FROM CHANNEL		
6 50-200' FROM CHANNEL		
4 <50' FROM CHANNEL		
2 MATERIAL ON BANK OR IN CHANNEL		

EXAMPLE: MATERIAL IS PRESENT WITHIN 50' OF CHANNEL BUT NOT ON THE BANK, RATE AS 4; THE AMOUNT OF MATERIAL IS COMMON, SUBTRACT 1; THE POTENTIAL TO REACH THE CHANNEL IS HIGH; SUBTRACT 2. OVERALL RATING = 4 - 1 - 2 = 1.

6. **WATER ODOR** [RANGE = 4 - 1]
4 NONE, 3 SLIGHT, 2 MODERATE, 1 STRONG (IT STINKS)

7. **DEWATERING** [RANGE = 8 - 1]
8 NO APPARENT WATER LOSS, 6 WATER LOSS NOTICEABLE/HABITAT OK, 4 HABITAT DRASTICALLY REDUCED/WILL SUPPORT ORGANISMS, 2 CHANNEL DRY OR DEWATERED TO SEVERE LOSS OF HABITAT.
IF DEWATERING APPEARS TO PRIMARILY BE HUMAN CAUSED **DIVIDE** EACH GENERAL RATING BY 2. **EXAMPLE:** WATER LOSS NOTICEABLE = 6, IF HUMAN CAUSED, DIVIDE BY 2 TO GET AN OVERALL VALUE OT 3.

8. **AQUATIC ORGANISMS** [RANGE = 5 - 1.5]
FISHERIES: IF FISH ARE OBSERVED; 1 PRESENT, 2 COMMON, 3 ABUNDANT
IF ABNORMAL FISH BEHAVIOR IS OBSERVED **DIVIDE** THE GENERAL RATINGS BY 2.

AQUATIC PLANT GROWTH:
DOES PLANT GROWTH APPEAR NORMAL (AS WOULD BE EXPECTED FOR THE SEASON AND NATURAL STREAM CONDITION) 2 YES, -1 NO.

TO CALCULATE AN OVERALL IMPAIRMENT RATING:
ADD THE TOTAL OF ALL RATED PARAMETER VALUES AND DIVIDE BY THE TOTAL POSSIBLE. THE RESULT WILL BE A PERCENTAGE OF THE TOTAL AND THE OVERALL RATING WILL BE BASED ON THAT PERCENTAGE. NOTE, THAT IF ALL PARAMETERS ARE NOT ASSESSED THE DIVISOR WILL BE BASED ON THE TOTAL OF THOSE PARAMETERS ACTUALLY RATED.

IMPAIRMENT VALUES
87 - 100% = NON-IMPAIRED, (FULL SUPPORT)
80 - 86% = NON-IMPAIRED, BUT THREATENED, (FULL SUPPORT)
71 - 79% = MINOR IMPAIRMENT, (PARTIAL SUPPORT)
55 - 70% = MODERATE IMPAIRMENT, (PARTIAL SUPPORT)
0 - 54% = SEVERE IMPAIRMENT, (NON-SUPPORT)

APPENDIX D. NPS Assessment Results Summarized by Stream

This appendix contains single page numerical summaries for each stream reach completed during this study. The numerical summaries are based on interpretation of information contained in the original stream reach assessment field forms, completed under contract by John Gangemi. The summaries were interpreted and prepared solely by the author of this report.

Summary narratives combining information for all reaches of a given stream are also found in this appendix after the numerical summary pages. The summary narratives were in part completed by the author of this report and based on excerpts from stream descriptions completed by John Gangemi. Several summary narratives are also presented as originally completed by Liz Hill. Liz and John completed the description for the Flathead National Forest who provided them for the author for this report.

Liz and John did not complete descriptions for several streams included in this study. For those streams, there are no narratives in this appendix.

STREAM NAME: BIG CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.22SW., T.33 N., R.20 W. to Sec.30 MID., T.33 N., R.21 W.. (mouth at confluence with N. Fork Flathead River to road # 803 x-ing)

RATING: 93% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	1/4	large slope eroding in Sec. 28
2. Land Use	3/4	timber harvest roads
3. NPS Pollution	8/8	
4. Bank Stability	11/12	
5. Substrate Composition	10/10	
6. Channel Stability	24/24	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: BIG CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.30MID., T.33 N., R.21 W. to Sec.33SW., T.33 N., R.21 W.. (road 803 x-ing to confluence with Hallowat Cr.)

RATING: 89% = non impaired, (full support) (Rating is based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	2/4	some logging in Sec. 33
3. NPS Pollution	8/8	
4. Bank Stability	10/12	large bank eroding in Sec. 30
5. Substrate Composition	10/10	
6. Channel Stability	21/24	overflow channels scoured
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	2.5/4	avg. 50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	debris moves with high flows
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: BIG CREEK
REACH NUMBER: III
REACH IDENTIFICATION: Sec.33SW., T.33 N., R.21 W. to Sec.11SE., T.32 N., R.22 W.. (confluence with Hallowat Cr. to Switchback road # 316 Sec. 11)

RATING: 94% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

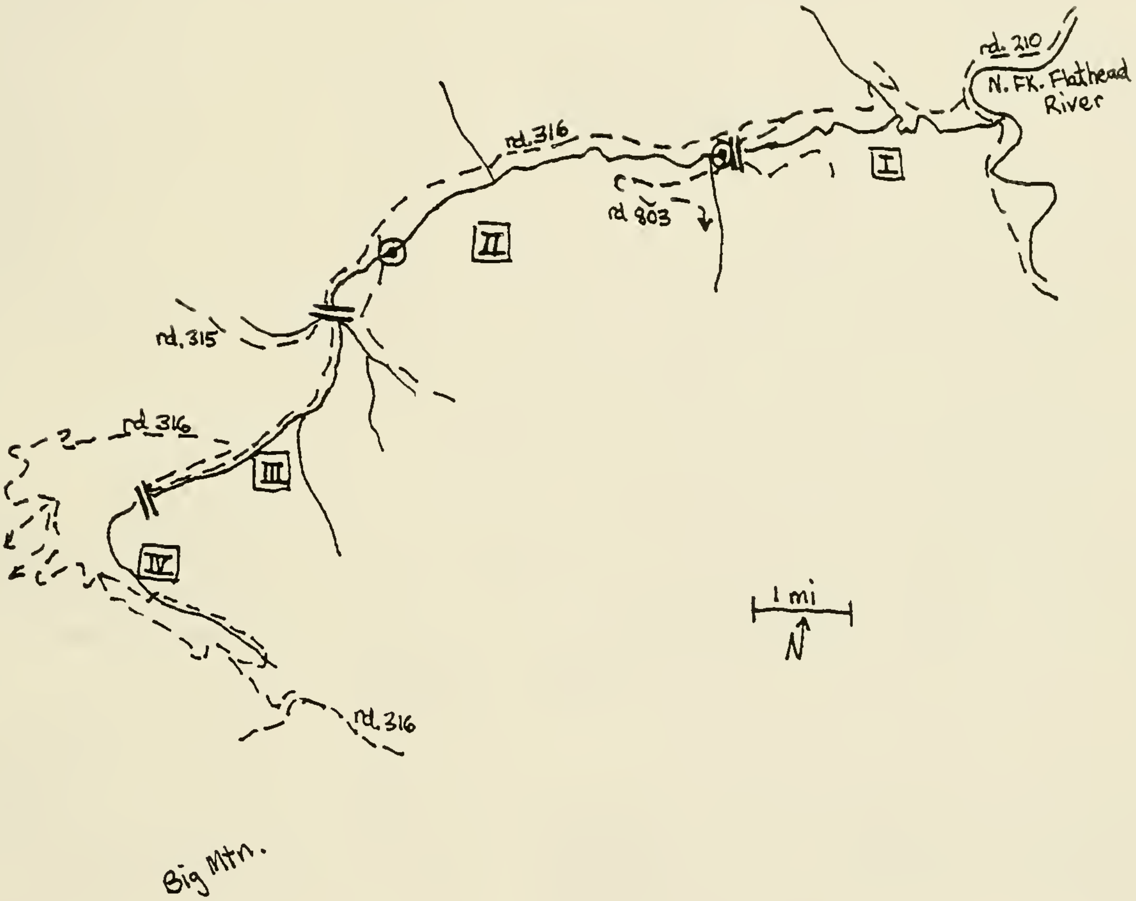
CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest, roads
3. NPS Pollution	7/8	minor amounts of slash and litter
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	15/16	none evident except at Hallowat Cr.
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	cable and slash in channel
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: BIG CREEK
REACH NUMBER: IV
REACH IDENTIFICATION: Sec.11SE., T.32 N., R.22 W. to Sec.24SE., T.32 N., R.22 W.. (switchback rd. 316, Sec. 11 to just downstream of road 316 x-ing Sec. 24)

RATING: 88% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	logging (sec. 24 entirely logged) roads, vehicles crossing stream in Sec. 14
3. NPS Pollution	5/8	slash, road closure berms built on stream bank vehicles are going around, potential sed. source
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	16/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	logging Sec. 24, poor SMZ
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	slash in channel
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/2	present
- plants	2/2	

BIG CREEK



‖ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

- - = Road

STREAM NAME: **CHALLENGE CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.32 SW., T.29 N., R.31 W. to Sec.28 NW., T.29 N., R.13 W.. (mouth, confluence with Dodge Creek to approximately 1/3 mile into sec. 28)

RATING: 72% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	3.5/4	several mass wasting areas abv. high water mark
2. Land Use	2/4	logging
3. NPS Pollution	8/8	
4. Bank Stability	6/12	flood damage, avg. size of eroding banks is >3' high X >20' long
5. Substrate Composition	20/30	embeddedness; riffles = 1/3, runs = >1/3
6. Channel Stability	15/24	braiding and channel scour present, pools filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3.5/4	blow down ?
- stream shading	3/4	51 - 75% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	3.5/4	debris causes scour and chan. migration
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **CHALLENGE CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.28 NW., T.29 N., R.13 W. to Sec.26 NW., T.29 N., R.13 W.. (approx. 1/3 mi. into section 28 NW to headwaters sec. 26)

RATING: 70% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	8/12	moderate bank eros. related to high flow; avg. size eroding banks = >3' high X >20' length
5. Substrate Composition	17/30	riffles and runs are 1/3 - 2/3 embedded, pools are dominated by fine sediment
6. Channel Stability	12/24	some channel scour and deposition, pools are filling, channel braiding or migration present
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	blowdown ?
- stream shading	3/4	51 - 75 % shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	debris jams cause braiding and scour
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: **Challenge Creek**

Challenge Creek flows in a southwesterly direction from the southwest side of Running Crane Mountain to the confluence with Dodge Creek where the two form Granite Creek. Challenge Creek is divided into two reaches totaling 3.9 miles in length. Gradient in both reaches is greater than 3 percent. Logging and roading activity occur in reach I only. A large (natural) eroding bank in the upper end of reach I (section 28 & 29 line) contributes sediment to the stream. At the end of road 5282 there is a tributary stream with avalanche damage. A cutting unit on the same tributary has no streamside management zone and may be compounding problems caused by the avalanche. Debris jams are lacking in this area.

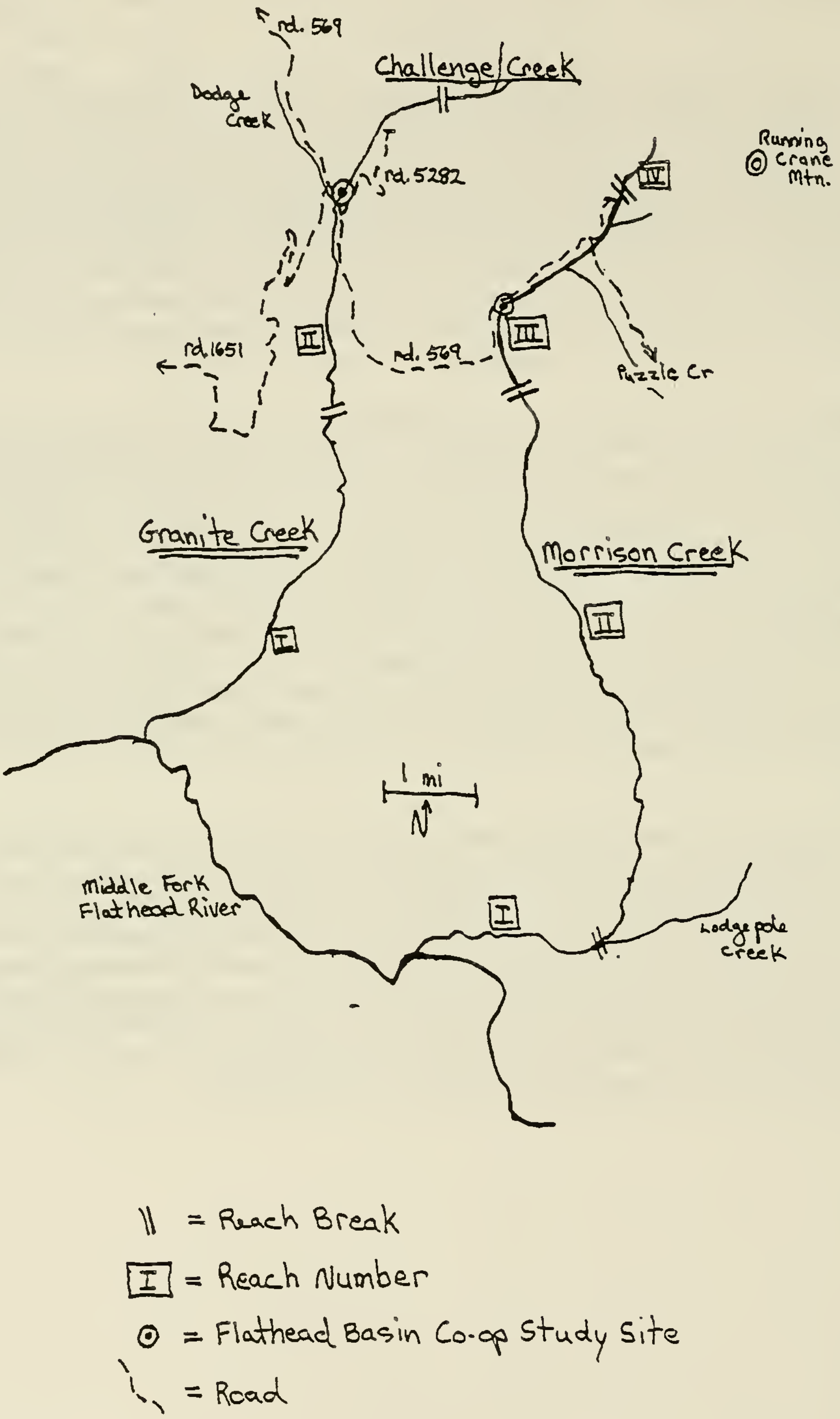
NARRATIVE DESCRIPTION OF STREAM FEATURES ON CHALLENGE CREEK

This narrative of stream characteristics on Challenge Creek begins at the Flathead National Forest's water quality monitoring station, located where the stream is crossed by road 569. This stream crossing has been washed out in the past and is now a cattle guard bridge with an overflow channel constructed to the south of the currently preferred channel. Upstream from the road the immediate valley bottom shows evidence of recent and historic channel migrations. The abandoned channels have characteristics similar to the presently preferred channel and are partially revegetated except where annual peak run-off travels. There are moderate to heavy accumulations of large woody debris (small spruce and lodgepole pine) and bank erosion is common through this lower reach. Cut-banks of two feet and higher are overhung by mats of roots. The material in the bottom of the stream is mostly loose and probably moves readily during peak flow periods. Organic material and fine sediments cover the gravels in most low velocity areas.

Cutting units, logged as part of the 'Middle Fork Lodgepole' timber sale, were surveyed for potential sediment sources in June 1990. Skid trail and fire line drainage bars showed some erosion. The cutting units accessed by road 9632 had water running down skid trails and across the road in several places where drainage structures had failed. Water had accumulated in the road ditch and some erosion was evident there as well. The buffer zone between unit 24 and Challenge Creek was walked to determine how effective it had been in filtering sediment. The combination of thick, low vegetation and a major slope break was 100 percent effective in preventing sediment from reaching the stream. This success was not seen in the buffer strip adjacent to [redacted] where water bars and drainage dips, installed on a skid trail that parallels an intermittent stream, also failed. In this unit the streamside management zone did not appear to be sufficient to trap all sediment that could be transported before reaching this live stream. Active mass failures along this small live stream that feeds into Challenge Creek indicate that it is inherently unstable. Some further mitigating measures are recommended to reduce the potential of erosion and additional contributions of sediment to Challenge Creek.

Channel Stability Surveys were conducted on Challenge Creek on the reach directly upstream from the water quality monitoring station and at a point above all management activities. These were then compared with surveys conducted by Forest personnel in 1987. The Survey conducted in July 1990 at the lower reach (above the water quality monitoring station) was rated as 'fair' (101). The 'undisturbed' stream also rated as 'fair' (92). These results agree with the surveys conducted in 1987 that rated the entire Challenge Creek as 'fair'. Active channel cutting and migrations, accumulations of large woody debris in and adjacent to the stream course, and the presents of mass failures throughout the stream's main stem and side tributaries suggests that the drainage transports a high level of sediment naturally. It may be difficult or impossible to separate 'natural' sediment from that generated by management activities in this watershed.

GRANITE, CHALLENGE and MORRISON CREEKS



STREAM NAME: COAL CREEK (mainstem)
REACH NUMBER: I
REACH IDENTIFICATION: Sec.20 SW., T.34 N., R.20 W. to Sec.29 NE., T.34 N., R.20 W.. (mouth at confluence with N. Fk. Flathead River to approx. 1/3 miles into sec 29 NE.)

RATING: 85% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	heavy equip. X-ing and recreational use in and near stream by N. Fk. road
3. NPS Pollution	6/8	litter from recreational use, grader berms on N. Fk bridge are a sed. source
4. Bank Stability	10/12	approx. 10% of the banks were undercut with bare soil exposed
5. Substrate Composition	10/10	upstream sed. traps may keep this reach clean
6. Channel Stability	8/8	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	some damage related to vehicle use
- stream shading	2/4	25 - 50% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	mostly litter from recreational use, sediment
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	-1/2	excessive algal growth

STREAM NAME: COAL CREEK (mainstem)
REACH NUMBER: II
REACH IDENTIFICATION: Sec.29 NE., T.34 N., R.20 W. to Sec.36 SE., T.34 N., R.21 W.. (approx. 1/3 mi. into sec. 29 NE. to road # 317 crossing sec. 29)

RATING: 82% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	16/20	riffles nearly 1/3 embedded, pools dominated by sand
6. Channel Stability	10/16	moderate sand deposition behind velocity breaks and in pools
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	2/4	25 - 50% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/A	none observed
- plants	-1/2	

STREAM NAME: COAL CREEK (mainstem)
REACH NUMBER: III
REACH IDENTIFICATION: Sec.36 SE., T.34 N., R.21 W. to Sec.35 SW., T.34 N., R.21 W.. (road # 317 crossing to confluence with Dead Horse Creek)

RATING: 91% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	2.5/4	mass wasting area, 50 X 300', adjacent to stream
2. Land Use	2.5/4	selective logging 50 - 200' from channel
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	19/20	
6. Channel Stability	6/8	slight sand deposition
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51 - 75% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/A	none observed
- plants	2/2	

STREAM NAME: COAL CREEK (mainstem)
REACH NUMBER: IV
REACH IDENTIFICATION: Sec.35 SW., T.34 N., R.21 W. to Sec.30 SE., T.34 N., R.21 W.. (confluence of Dead Horse Creek to confluence of South Fork Coal Creek)

RATING: 89% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	Clear cut unit, 5 - 10 yrs. old, 50 to 200' from channel
3. NPS Pollution	8/8	nothing attributable to logging
4. Bank Stability	12/12	
5. Substrate Composition	9/10	some sand deposition, but less than 1/3 embd.
6. Channel Stability	12/16	some sand deposition behind velocity breaks and associated minor pool filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51 - 75% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	normal plant growth

STREAM NAME: COAL CREEK (North Fork)
REACH NUMBER: V
REACH IDENTIFICATION: Sec.30 SE., T.34 N., R.21 W. to Sec.25 NW., T.34 N., R.23 W.. (confluence with S. Fork Coal Creek to confl. of southern ephemeral trib. sec. 25 NW)

RATING: 80% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	extensive CC harvest approx. 2 miles along stream
3. NPS Pollution	5/8	occasional logging slash in stream; temp. increase potentially related to canopy removal
4. Bank Stability	12/12	
5. Substrate Composition	9/10	appeared to be higher embeddedness in headwater area than downstr. Overall embeddness = <1/3 ?
6. Channel Stability	6/8	low to moderate deposition in backwater areas
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	substantial harvest along stream
- stream shading	2/4	avg. shading = 25 - 50, but variable
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	occasional logging slash, but lots of natural debris
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	

STREAM NAME: COAL CREEK (North Fork)
REACH NUMBER: VI
REACH IDENTIFICATION: Sec.25 NW., T.34 N., R.23 W. to Sec.36 NW., T.34 N., R.23 W.. (confluence with southern ephemeral trib. sec. 25 NW. to headwaters section 36 NW.)

RATING: 100 % = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	8/8	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	fisherman reported catching fish in this reach
- plants	2/2	

STREAM NAME: **SOUTH FORK COAL CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.30 SE., T.34 N., R.20 W. to Sec.34 NW., T.34 N., R.22 W.. (confluence with mainstem Coal Cr. to road # 317 crossing)

RATING: 78% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	3.5/4	avalanche chutes, but no erosion evident
2. Land Use	1/4	extensive logging adjacent to stream
3. NPS Pollution	8/8	none observed
4. Bank Stability	10/12	minor high bank under cutting
5. Substrate Composition	7/10	riffles approximately 1/3 embedded
6. Channel Stability	5/8	some scour and minor sand deposition
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	substantial canopy removal by logging
- stream shading	2/4	average = 25 - 50% shading, but variable
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	habitat improvement structures added by MFW&P
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	no logging slash observed in stream
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	

STREAM NAME: **SOUTH FORK COAL CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.34 NW., T.34 N., R.22 W. to Sec.31 SW., T.34 N., R.22 W.. (road 317 crossing to extreme SW corner of section 31, end of perennial)

RATING: 83% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	significant logging adjacent to stream
3. NPS Pollution	6/8	logging slash in stream
4. Bank Stability	11/12	minor undercutting
5. Substrate Composition	9/10	generally a high gradient cobble/ rubble chan. type with mino deposition of sand in riffles
6. Channel Stability	6/8	some deposition of sand in low gradient areas
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	canopy removal by logging
- stream shading	3/4	51 - 75% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	survey noted some avalanche related large debris jams nea Mathias Cr.
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	1/8	logging slash in channel
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

NARRATIVE DESCRIPTION OF STREAM FEATURES IN COAL CREEK

This narrative description of stream features is a combination of observations made by Tom Weaver of the Montana Fish Wildlife and Parks Department during a survey conducted in 1988 and by Liz Hill during a survey for potential sediment sources conducted in July 1990. Tom's survey ran from the headwaters of Coal Creek to the bridge crossing which accesses the Deadhorse Creek drainage and is being used to describe the upper basin characteristics which are not readily accessible given the current project's time constraints. In most cases where he reported effects of management activities I reviewed them personally this year to compare our interpretation of conditions and check on mitigating measures that have been initiated.

The upper portion of the South Fork of Coal Creek is undeveloped. There are short sections of unstable channel with windthrow along the stream's edge, heavy natural debris accumulations within the stream in several spots, raw banks, and depositional zones of sharp angular rocks. This upper portion should be considered as having some natural potential to contribute sediment to Coal Creek.

The lower portions of both the South Fork of Coal and Mathias creeks were logged in the early 1960's in conjunction with the spruce bud worm epidemic and again in the late 1970's or early 1980's. Old logging debris and equipment crossings are present in the two or three mile reach above where these streams join in section 34. Active erosion is occurring in several places in an old cutting unit that surrounds a tributary of Mathias Creek located in section 4. Fisheries biologists from the S.O. and the district have installed sediment traps and velocity dissipaters in places identified by Tom Weaver's report as sediment sources in an attempt to mitigate these situations. It was noted in this year's survey that straw bales placed in the ditch along road 317 within this unit are filling with sediment and cross currents are causing erosion of the road bed and cut slope of the road. This ditch feeds into a small intermittent stream. Further mitigating measures are recommend in this area. A follow-up review is scheduled to be conducted this summer by the Forest biologists .

Units included in the "South Fork Coal Sale" were surveyed for potential sediment sources. In section 29 there are several drive-through stream crossings of small tributaries that are of some concern. At present they see very little traffic and most are relatively stable. Any increased use linked with future management activities should be closely scrutinized. A small slump (15 ft. by 25 ft.) has occurred at the intersection of road 1686 and 1604 that leads into this unit, indicating that these soils tend to be unstable, especially when natural drainage patterns are disturbed. Rubble has plugged the ditch at this intersection and the diverted runoff has eroded parts of the road surface. This runoff drains into a tributary of the South Fork of Coal in the southeast corner of section 30. The old drive-throughs and surrounding area is being considered as a future site for rehabilitation efforts. It should be noted that the majority of the road surfaces in the entire south fork of Coal have been seeded and are 50 to 90 percent revegetated.

The Flathead National Forest has established a water quality monitoring station at the bridge where road 1687 crosses the South Fork of Coal. Yellow Bay Biological Station has established a pair of sampling stations above and below an old cutting unit down stream from the bridge.

A Channel Stability Survey conducted in July 1990 rated the reach above the south fork bridge as "fair" (88). This evaluation agrees with a survey done in 1985 by Forest personnel which also rated this section as "fair" (91).

The south fork of the main fork of Coal Creek flows from Haines Pass and is undeveloped for approximately the first mile. Some natural slumps are present and the upper slopes were noted to be highly erosive, but the stream channel is basically stable. Some potential for natural sediment contributions exists.

Old cutting units are located in section 25. Drainage problems were noted in a unit located adjacent to the trailhead for trail #26 and along the trail. Old equipment crossings and accumulations of debris was present from this point to where this fork meets the main fork of Coal. Many small tributaries that run through old cutting units in this area have historically transported eroded materials to the main stem. This area was considered "a major sediment source" by Weaver's report and is included in the area being reviewed for mitigating measures.

In section 24 erosion is evident at the base of a cutting unit included in the "Raghorn" timber sale. It appears that either too few water bars were installed or that those installed were simply ineffectively constructed along skid trails to prevent surface erosion. This area is a concern as a potential sediment source due to its close proximity to the main stem of Coal Creek. Bails of straw, installed in the road ditch to catch sediment washing from the cutting units, have deflected runoff perpendicularly and caused both the cut bank and the road bed to erode. Sediment and gravel have been transported through the culvert at the bottom of the unit (the culvert installation is also eroding and sloughing) and are deposited within 10 feet of Coal Creek. Further mitigating measures are recommended.

The main stem of Coal Creek flows from an unnamed lake in section 23. The channel below this point is characterized by several cascades and water falls. The stream gradient is steep but considered stable.

An old cutting unit is located on the north side of the stream in section 13. Debris accumulations and historic channel migrations were noted. Sediment sources were identified where old road crossings were eroding and in three moderately sized "natural" slumps. There is also an active "natural" cut bank (45 feet long by 10 feet high) downstream in section 24. Below this point the stream passes through another old cutting unit. Logging debris is present in the channel and there is evidence of beaver activity adjacent to the stream. Channel migrations attributed to debris accumulations or log jams have historically occurred. Active bedload movement is evidenced by gravel deposition within the active stream course.

The Flathead has established a water quality monitoring station at the bridge where road 317 crosses the main stem of Coal Creek.

A Channel Stability Survey conducted in July 1990 rated the stream reach above the bridge crossing of road 317 as "good" (71). A survey conducted in 1985 by Forest personnel rated the same segment of stream as "fair" (77). Although this year's score is a little better than the rating done in 1985, there is not enough difference to indicate any major change, especially since 77 is the dividing point between "good" and "fair".

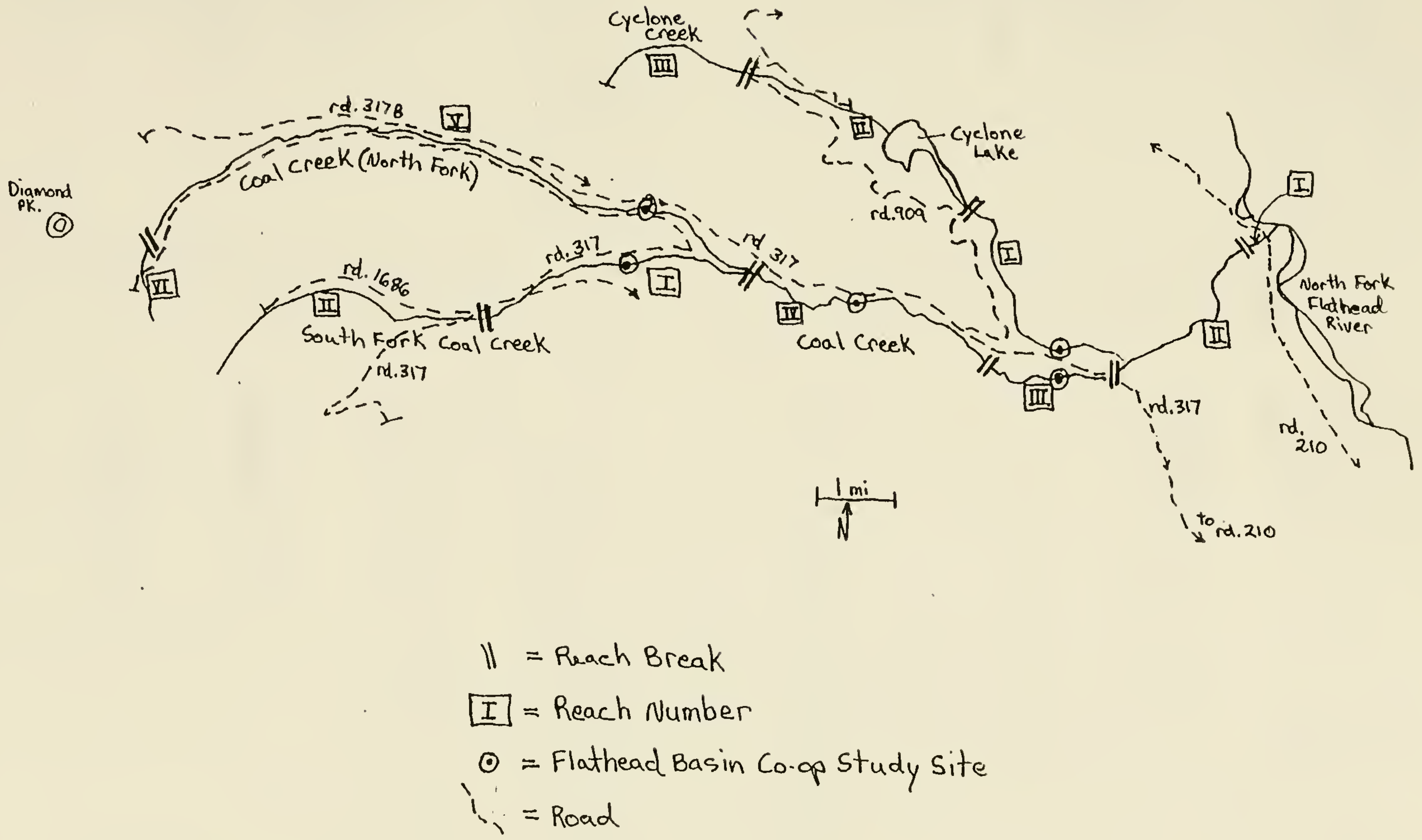
This watershed is owned and managed by the Montana Department of State Lands from the break between Range 21 and 22 to the end of this survey at the water quality monitoring station establish by the Flathead National Forest where Coal Creek passes under what is known as the Deadhorse bridge. The main stem of Coal Creek below the confluence of the north and south forks is characterized by a broad valley in which the stream often splits into many braided channels. Debris accumulations are common but rarely if every extend across the entire width of the stream. Beaver activity is evident in and along the sides of the active channels. Gravels are often loose and active bar migration is evident. During Weaver's survey in 1988 he noted that a portion of the stream in section 29 was dry.

Some of the bottom area was logged in 1960, probably in conjunction with the spruce bud worm epidemic previously mentioned. Other logging occurred in the summers of 1987 and 1988. No potential sediment sources were noted adjacent to Coal Creek along this lower portion.

A Channel Stability Survey conducted in July 1990 rated the reach directly above the water quality monitoring station as "good" (67). This is again slightly higher than the score given the same reach in 1985, when Forest personnel rated this section of stream as "good" (75).

It should be noted that Coal Creek has some potential sediment sources that occur naturally, well above any existing management activities. It may be difficult or impossible to attribute changes in water quality to any one specific thing with a reasonably high level of confidence.

COAL (NORTH & SOUTH FORKS) & CYCLONE CREEKS



STREAM NAME: CYCLONE CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.36SE., T.34 N., R.21 W. to Sec.22SE., T.34 N., R.21 W.. (mouth at confluence with Coal Creek to outlet of Cyclone Lake)

RATING: 87% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	old timber harvest
3. NPS Pollution	7/8	minor amount of old slash in stream
4. Bank Stability	11/12	good except in Cyclone Park area
5. Substrate Composition	10/10	
6. Channel Stability	11/16	deposition in pools
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	fairly open in Cyclone Park area only (1 mi.)
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	3/8	off color, brown
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	5/8	old slash
14. Water Odor	4/4	
15. Dewatering	6/8	
16. (Aquatic Organisms)	-	
- fish	1/3	shallow flow over gravel bar at mouth may inhibit fish passage
- plants	2/2	

STREAM NAME: CYCLONE CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.16SE., T.34 N., R.21 W. to Sec.7SE., T.34 N., R.21 W.. (inlet of Cyclone Lake to road 909 crossing at switch back, Sec. 7)

RATING: 90% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest >10 yrs. old, equipment & road crossing
3. NPS Pollution	7/8	minor amounts of slash
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	16/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	clear cut up to stream
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	minor amounts of slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish		
- plants	2/2	

STREAM NAME: CYCLONE CREEK
REACH NUMBER: III
REACH IDENTIFICATION: Sec.7SE., T.34 N., R.21 W. to Sec.12SW., T.34 N., R.22 W.. (road 909 crossing to SW Sec. 12 line)

RATING: 99% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	3/4	timber harvest, roads
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	16/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/89	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: **Cyclone Creek**

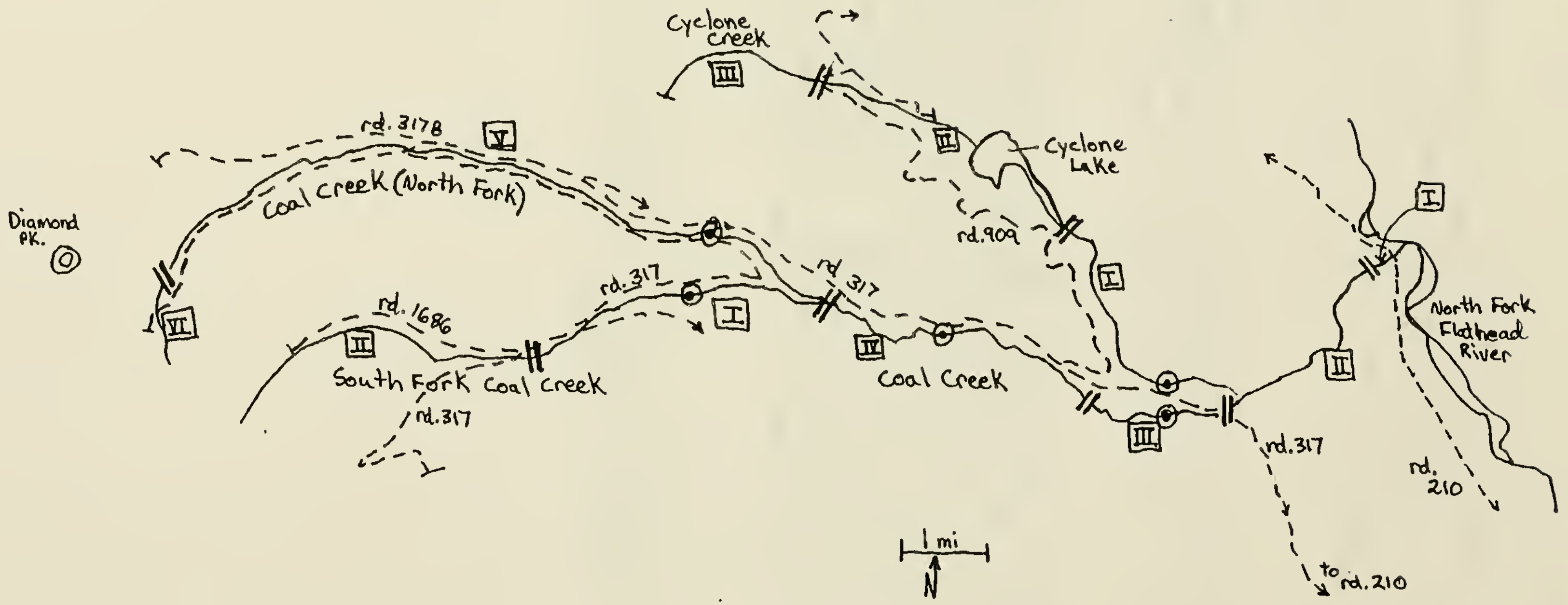
Cyclone Creek flows southeast from the north side of Coal Ridge approximately 9.5 miles through Cyclone Lake to its confluence with Coal Creek. Beginning at the mouth the stream is divided into three reaches (I - III). The average gradient for reach II and III is 9 percent and 2.5 percent in reach I. Management activity (logging and roads) occurs in reach I and II only. Specific conditions and problems observed by the surveyor are listed below.

Reach I
Substrate consists of cobble and gravel. Woody debris jams occur sporadically throughout the reach and generally cause no channel problems. Banks are stable and well vegetated except for isolated areas in Cyclone Park. The canopy opens and sandy deposition is common in the Cyclone Park area.

Reach II
The channel is stable with well vegetated banks. Substrate consists mainly of cobble and small boulders. Debris jams occur infrequently however, logging slash is present in the jams. This reach has been logged extensively. The streamside management zone is narrow and almost non-existent in places. Several seeps and first order streams have no SMZ. These occur on steep terrain and some of the drainages have eroded banks up to one foot high. Some old slumps were visible however, most are currently stable. Heavy equipment has crossed the creek directly upstream of the bridge on road 909. The banks are raw on either side of this crossing. Road surface erosion drains into road ditches on the north side of the bridge. These ditches lack sediment filters and contribute sediment to the creek.

Reach III
Banks are stable and well vegetated. Debris jam occur intermittently and create only minimal channel problems. Substrate consists of cobble and small boulders and is unembedded. There are no management activities.

COAL (NORTH & SOUTH FORKS) & CYCLONE CREEKS



‖ = Reach Break

$\boxed{I}$ = Reach Number

⊙ = Flathead Basin Co-op Study Site

- - = Road

STREAM NAME: ELK CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.35 NE., T.21 N., R.17 W. to Sec.3 SW., T.20 N., R.17 W.. (mouth at confluence with the Swan River to near end of two unnumbered roads extreme SW. of sec. 3)

RATING: 61% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	logging, grazing
3. NPS Pollution	4/8	slash, litter, manure
4. Bank Stability	7/12	debris (inclds. slash) contributes to channel erosion
5. Substrate Composition	19/30	riffles near 1/3 embedded, runs 1/3 - 2/3 embd. pools have approx. 50% fines
6. Channel Stability	8/16	moderate scour and deposition, pool size decreasing due to deposition
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2.5/4	blowdown attributable to logging
- stream shading	2/4	25 - 50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	1/4	blowdown creates debris jams that are causing channel erosion
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	1/8	see #3 above
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	normal plant growth

STREAM NAME: ELK CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.3 SW., T.20 N., R.17 W. to Sec.17 SE., T.20 N., R.17 W.. (extreme SW corner of section 3 to just inside sec. 17 SE. near the 16 & 17 sec lines)

RATING: 78% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

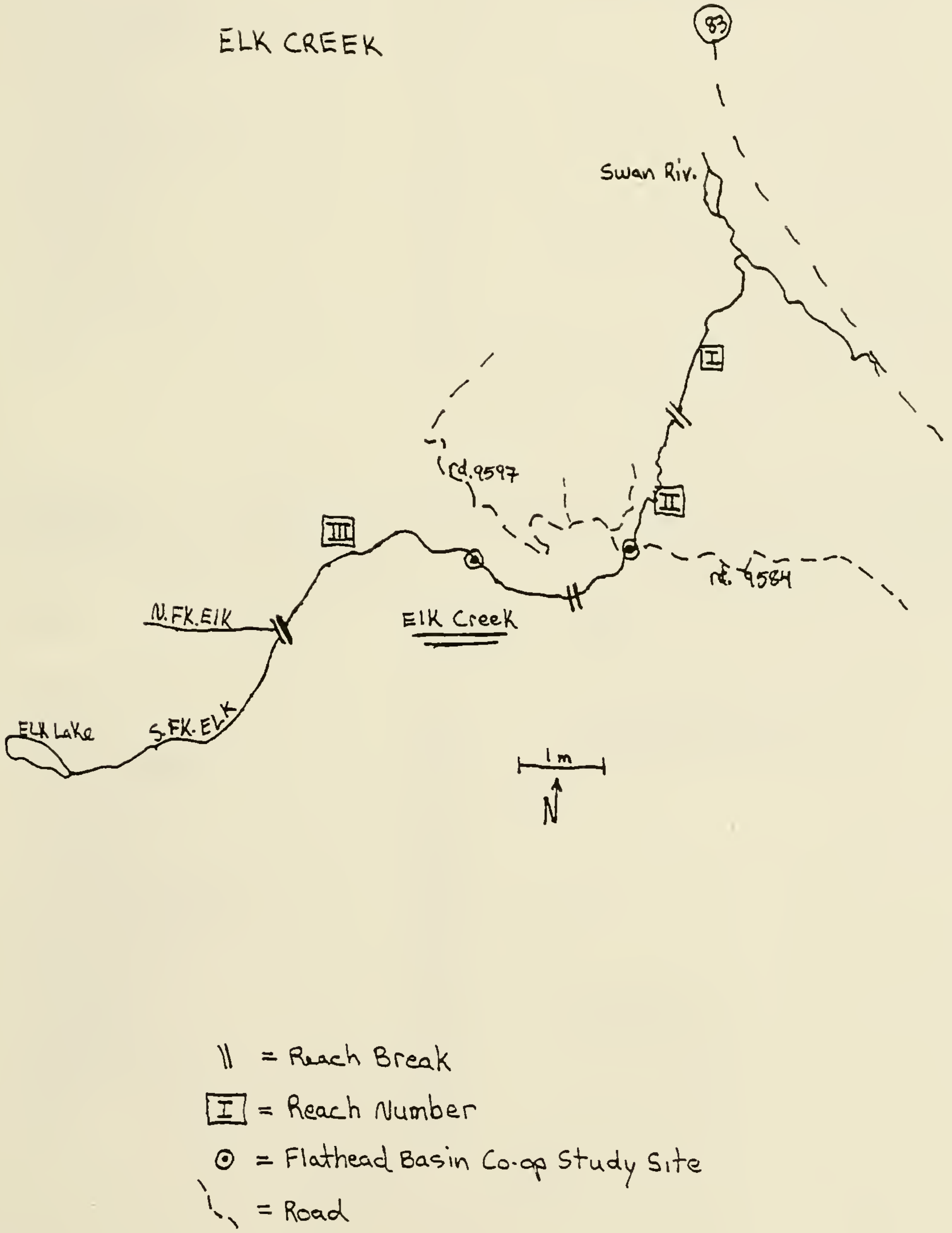
CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	2/4	selective logging?, grazing
3. NPS Pollution	6/8	minor amounts of slash in stream
4. Bank Stability	9/12	slumps in a few areas, eroding undercuts
5. Substrate Composition	14/20	riffles = 1/3 embedded, runs = 1/3+ embedded
6. Channel Stability	11/16	scouring at constrictions, pools filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51 - 75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	minor amounts of slash in channel
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	normal growth

STREAM NAME: ELK CREEK
REACH NUMBER: 111
REACH IDENTIFICATION: Sec.17 SE., T.20 N., R.17 W. to Sec.23 NW., T.20 N., R.18 W.. (just inside sec. 17 SE. to the confluence of the N. and S. Forks)

RATING: 91% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	14/20	riffles are somewhat cemented, pools filling with sand
6. Channel Stability	21/24	pools filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	logs in stream provide fish cover
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

ELK CREEK


83
Swan Riv.
I
rd. 9597
II
rd. 9584
III
N.FK.Elk
Elk Creek
S.FK.ELK
Elk Lake
1m
N
= Reach Break
I = Reach Number
= Flathead Basin Co-op Study Site
= Road

STREAM NAME: **EMERY CREEK**
REACH NUMBER: 1
REACH IDENTIFICATION: Sec.7., T.30 N., R.18 W. to Sec.4NW., T.30 N., R.18 W.. (mouth at Hungry Horse Reservoir to confluence of tributary near road #1048)

RATING: 76% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	3/8	slump located NW portion of Sec. 10
2. Land Use	3/4	
3. NPS Pollution	6/8	road 546 graded material placed near stream apparent new sediment deposition in stream
4. Bank Stability	5/12	large (>3' x >20') slumping banks
5. Substrate Composition	10/10	
6. Channel Stability	13/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3.5/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	minor slash and litter
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	2/2	

STREAM NAME: **EMERY CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.4NW., T.30 N., R.18 W. to Sec.20SW., T.31 N., R.18 W.. (confluence of tributary near road #1048 to just above junctions of road #546 & 1614)

RATING: 90% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest, roads
3. NPS Pollution	7/8	in stream sediment deposition?
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	11/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	old bridge logs
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	2/2	

STREAM NAME: EMERY CREEK
REACH NUMBER: III
REACH IDENTIFICATION: Sec.20SW., T.31 N., R.18 W. to Sec.16SW., T.31 N., R.18 W.. (first order triburaries, confluence with Emery Cr. near road #1048 into Sec. 16)

RATING: 96% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	3/4	timber harvest, roads
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	14/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	2/2	

Stream Name: **Emery Creek**

Emery Creek flows south from the west ridge of Pyramid Peak approximately 7.4 miles to Emery Bay on Hungry Horse Reservoir. This stream was divided into three reaches beginning at the mouth. Management activity (logging and roads) occur in reaches I and II and at the very lower end of reach III just above road 546. Specific conditions or problems observed by the surveyor are listed below.

Reach I

Stream gradient in this reach is approximately 2.5 percent. The banks are stable and well vegetated. Debris jams occur intermittently but have no negative effects on channel or bank stability. Road 1048 parallels and is directly adjacent to the stream in several locations. In these locations stream sedimentation due to road erosion and maintenance is probable. A light dusting of sediment was observed in the stream at the time of assessment. A slump located approximately 0.75 miles upstream of the reservoir was identified as having a moderate potential to cause stream sedimentation. Logging was common in this reach and no obvious impacts were observed.

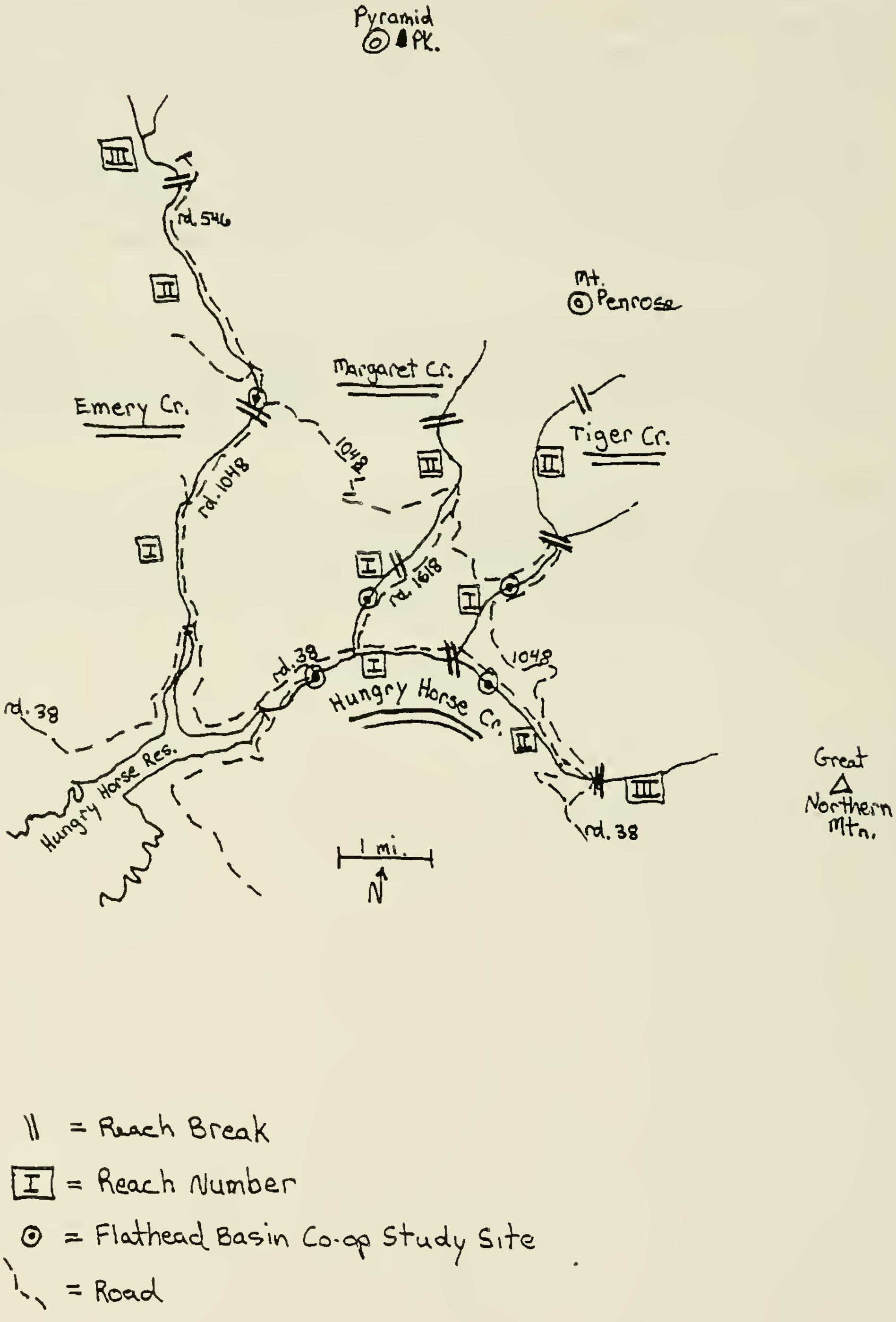
Reach II

The stream channel character is similar to reach I however, point bars were evident and pools were filling with coarse sand. Channel scour in the steep gradients of reach III may be the source of this bedload deposition in lower gradients of reach II. Again, no logging problems were observed.

Reach III

A very steep (32% gradient) second order reach. Very little human activity occurs in this reach except for one cutting unit in section 20 at the end of road 546. A wildfire also occurred in this area. Best management practices were applied to all logging and fire fighting activities and no stream impacts observed.

EMERY, MARGARET, TIGER, HUNGRY HORSE CREEKS



STREAM NAME: FISH CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.15 NW., T.28 N., R.24 W. to Sec.9 SW., T.28 N., R.24 W.. (mouth to extreme SW. 1/4 of section 9)

RATING: 68% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	recent timber harvest adjacent to chan.
3. NPS Pollution	3/8	sediment, slash, litter
4. Bank Stability	7/12	logging and natural debris is causing bank erosion
5. Substrate Composition	16/20	riffles avg. 1/3 embedded
6. Channel Stability	16/24	evidence of braiding, minor pool filling and some chan. scour and deposition
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	poor SMZ in harvest area
- stream shading	2/4	25-50% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	2.5/4	logging slash & natural debris contributes to chan braiding and bank erosion
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	0/8	logging slash, litter, sediment
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	3/3	fish were abundant!
- plants	-1/2	moss and algae excessive

STREAM NAME: FISH CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.9 SW., T.28 N., R.24 W. to Sec.8 NW., T.28 N., R.24 W..
(extreme SW 1/4 of section 9 to headwaters section 6)

RATING: 79% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	3/4	timber harvest >200' from channel
3. NPS Pollution	4/8	road headcut (sec.3 SE) contributes sed. to stream
4. Bank Stability	12/12	
5. Substrate Composition	14/20	riffle embeddedness 1/3 - 2/3
6. Channel Stability	16/24	braiding present, pools filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	debris has caused minor channel braiding
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	cut logs, litter, sediment
14. Water Odor	4/4	
15. Dewatering	8/8	none noted despite being an intermittent stream
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	-1/2	moss growth appears excessive given conditions

NARRATIVE DESCRIPTION OF STREAM FEATURES ON FISH CREEK

This narrative description of stream characteristics on Fish Creek begins at water quality monitoring station, established by the Flathead National Forest, below the Ashley Lake road. The channel is predominately composed of large angular rocks with course gravels filling the pools and forming point bars. The land adjacent to the creek for the first one-third mile is owned by Plum Creek Timber Company and was logged in 1987 to remove lodgepole pine killed as a result of the mountain pine beetle epidemic. The streamside management zone that was left along the stream varies in width from 0 to approximately twenty feet and consists of mostly deciduous trees and some small spruce. As of July 1990, 20 to 50 percent of the buffer zone had blown down. Root wads exposed by the windthrow has caused the channel to shift into pools created by the pockets. Debris accumutaions are heavy in spots and sediment is visible on the stream bottom where flow velocity is low. This may cause some concern since this creek is a major spawning stream for Ashely Lake.

Fish Creek flows through Forest Service land one-third of a mile above Ashley Lake. In east half of section 16 there are two cutting units that were logged in 1986 and have adequate riparian areas remaining along the stream. Sediment accumulations were noted in still-water areas but gravels were clean in high velocity, main-channel areas.

In the northwest corner of section 16 is another cutting unit logged in 1986. It's boundary was apparently expanded during logging to reach to the creek and some spruce appears to have been yarded across the stream from the opposite side. Many large spruce blew down along the edge of the unit after logging on both the main stem of Fish Creek and a side tributary on the south side of this unit. Rehabilitation projects were completed after logging to minimized sediment contributions. Wind thrown trees were cut from their root wads in an attempt to reseat the wads back into pockets along the stream's banks. Instream diversions have been installed to divert water away from exposed soil. There is still a high potential for sediment contributions to Fish Creek from this unit. Additional sediment control efforts might include planting of willow cuttings along the raw edges of the re-settled root wads and application of seed along the skid trail tnat parallels the tributary on the south side of the cutting unit within fifteen feet.

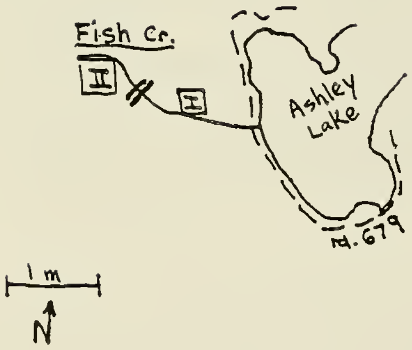
There is also a problem where the tributary crosses road 10236. A skid trail runs up the draw above the road for approximately 100 yards. Water has flowed down this trail, eroding the trail's surface and diverting the main flow of the tributary out of its formerly preferred channel. Large volumes of soil, gravel and logging debris has been deposited on the up-stream side of the road crossing. The stream no longer runs through the provided culvert, but flows down the ditch to the north for 75 to 100 feet. At some point the water sinks, seeps under the road, then surfaces in a slash pile on the down hill side of the road. These conditions suggest that there is a possibility that the entire road could slump into this side tributary of Fish Creek in the future. Efforts to correct this drainage problem are suggested.

Approximately one third mile upstream from this cutting unit on the main stem of Fish Creek is another pocket of blowdown that has been partially removed via a skid trail on the west side of the stream. The main channel of Fish Creek is cluttered with branches in several places between this blow down patch and the logging unit below. The gravel in the channel is again clean in the dominant flow areas and covered with a fine, dark silt in still water areas. Additional mitigating measures are recommended to prevent future bank deterioration.

The upper sections of Fish Creek flow through narrow "V" shaped valleys with reaches characterized by large angular rocks and intermittently subsurface flows. There are no obvious potential sources of sediment at any road crossing or adjacent to any other management activity. The channel is stable with little natural debris and only a few small cut banks.

A Channel Stability Survey was conducted in July 1990 on the reach that begins at the water quality monitoring station and continues upstream for approximately one mile. This portion of Fish Creek rated "fair" (101). In a survey conducted in 1986 same reach rated "good" (68 - 72) and "good" (55) on a survey done in 1980. The main components that have changed in the first four year period are related to bank cutting and filling of pools, a shift of bottom material composition, and additional contributions of large woody materials. Several things noted on the original form suggest that a change was in the process at that time. In the lower section of the reach it was noted that "Area was recently logged, trees cut at streamside, cut trees in stream." In the second half of the reach "Many cottonwood and aspen have blown down near stream's edge. A great deal of new logging debris in stream." Although it is understood that no two people will rate the same reach exactly the same numerical value, it is generally agreed that the reach score will average out to the same category (i.e. good, fair, etc.). The decreased Channel Stability score in Fish Creek suggests that some channel degradation is occurring, and that it is probably directly connected to logging activities that did not successfully implement currently accepted Best Management Practices.

FISH CREEK



‖ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

⋱ = Road

STREAM NAME: GOAT CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.18 SW., T.23 N., R.17 W. to Sec.17 SW., T.23 N., R.17 W.. (mouth at confluence with the Swan river to the confluence with Squeezer Creek)

RATING: 60% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	logging slash, one horse pasture
3. NPS Pollution	5/8	slash, litter, manure
4. Bank Stability	7/12	large debris jams (50% slash) cause verticle eros. and undercuts
5. Substrate Composition	19/30	riffles avg. <1/3 w/ some up to 2/3 embedded, runs are 1/3 - 2/3 embedded, pools filling
6. Channel Stability	9/24	severe scour and deposition, pools severly reduced, some braiding at debris jams
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	selective harvest
- stream shading	3/4	51 - 75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	1/4	large debris jams causing substantial stability problems
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash, litter (blw. hwy.) source of logging slash located in upstr. reaches
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	plant growth appears normal

STREAM NAME: GOAT CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.17 SW., T.23 N., R.17 W. to Sec.10 SW., T.23 N., R.17 W.. (confluence with Squeezer Cr. to mid sec. 10 just downstr. of intermittent trib. S. side)

RATING: 83% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest > 10 yrs. old
3. NPS Pollution	6/8	slash in stream
4. Bank Stability	12/12	
5. Substrate Composition	25/30	riffles avg. <1/3 embedded, runs 1/3 - 2/3 embd., pools filling but less than reach I
6. Channel Stability	11/16	point bars present, minor scour at constrictions
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51 - 75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	debris could move with floods
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	some slash in channel
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1.5/3	abnormal fish behavior (lethargy?) noted
- plants	2/2	

STREAM NAME: GOAT CREEK
REACH NUMBER: III
REACH IDENTIFICATION: Sec.10NE., T.23 N., R.17 W. to Sec.7NW., T.23 N., R.17 W.. (mid sec. 10, downstream of intermittent tributary to sec. 7 line, NW corner)

RATING: 69% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest c.c.
3. NPS Pollution	4/8	slash, excessive sedimentation
4. Bank Stability	12/12	
5. Substrate Composition	12/30	riffles 1/3-2/3, runs > 2/3, pools filling
6. Channel Stability	11/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3.5/4	some blowdown in narrow buffer strips
- stream shading	4/4	
- sed. filtering capacity	3/4	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: GOAT CREEK
REACH NUMBER: IV
REACH IDENTIFICATION: Sec.7NW., T.23 N., R.16 W. to Sec.7NE., T.23 N., R.16 W.. (sec. 7 NW, line to sec 7 NE, line)

RATING: 71% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest, c.c.
3. NPS Pollution	6/8	slash, sediment
4. Bank Stability	7/12	blowdown in logged areas, equipment X-ing
5. Substrate Composition	6/10	
6. Channel Stability	11/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	blowdown
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	
14. Water Odor	4/4	
15. Dewatering	2/8	Natural/subsurface flow
16. (Aquatic Organisms)	-	
- fish	N/F	
- plants	2/2	

STREAM NAME: **GOAT CREEK**
REACH NUMBER: **V**
REACH IDENTIFICATION: Sec.7NE., T.23 N., R.16 W. to Sec.9SW., T.23 N., R.16 W.. (Section 7, NE line to Forks, Sec. 9 SW)

RATING: 99% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	15/16	light dusting of sediment in pools
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: **Goat Creek**

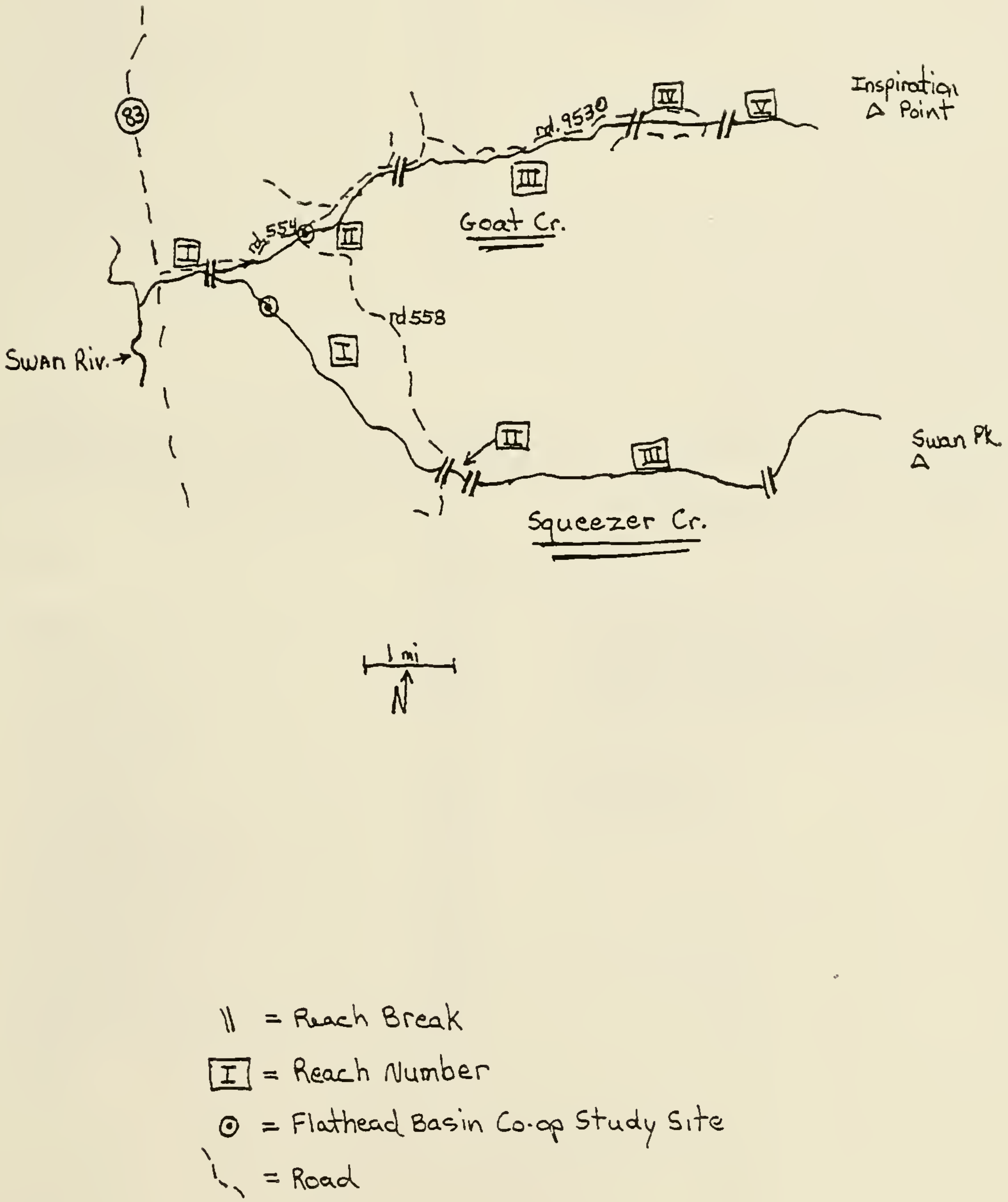
Goat Creek flows west from the northwest slope of Inspiration Point for approximately 13 miles to its confluence with the Swan River. The stream is divided into five reaches beginning at the mouth. Management activity (logging, roading, minor grazing) occurs throughout, but is very limited in reach V. Specific conditions or problems observed by the surveyor are listed below.

Reach I and II
Gradient averages 1 percent in reach I, and 2 percent in reach II. Both reaches are characterized as depositional. The substrate in the slower current areas was 1/3 to 2/3 embeddedness. Channel instability associated with debris jams was observed and most prominent in reach I. Logging slash was evident in the jams. Banks were eroding on bends. Erosion was observed at an old bridge site approximately 0.5 miles downstream of the bridge on road 9758.

Reach III and IV
The gradient in these reaches averages 5 percent however, the downstream end of reach III is less than 4 percent. Point bars, pool filling, and substrate embeddedness of 1/3 to 2/3 were observed in this area of reach III. A patchy buffer strip exists in an older logging unit in section 6 an 7. Stream shading is limited in this area and blowdown has occurred causing areas of bank instability. Stream crossing by equipment was also observed in this area. Bank disruption caused by blowdown was also observed in a narrow buffer strip in section 11. Portions of reach IV (section 7) were dewatered due to subsurface flow.

Reach V
This reach has an average gradient of 16 percent. One older cutting unit exists in the northeast quarter of section 7. The surveyor observed no problems associated with this harvest.

GOAT & SQUEEZER CREEKS



STREAM NAME: **GRANITE CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.35SW., T.28 N., R.14 W. to Sec.7SW., T.28 N., R.13 W.. (mouth at confluence with Middle Fork Flathead to just downstream of cutting unit S. Sec. 7)

RATING: 70% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	2.5/4	deep gully erosion
2. Land Use	4/4	only use is recreational
3. NPS Pollution	8/8	
4. Bank Stability	5/12	large slumping banks avg. >3'x>20', related to chan. migration
5. Substrate Composition	15/20	riffles <1/3, runs 1/3-2/3 embedded
6. Channel Stability	8/16	scour associated with chan. migration, pool size decresed due to filling
7. (Streamside Veg.)	-	
- % bare ground	3/4	15-30% bare ground
- avg. width veg. zone	4/4	
- use or damage	3/4	high flow damage
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	2/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	2/2	

STREAM NAME: **GRANITE CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.7SW., T.28 N., R.13 W. to Sec.32SW., T.29 N., R.13 W.. (just downstream of cutting unit S. Sec. 7 to confluence of Challenge and Dodge creeks)

RATING: 71% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	3/4	primarily in Sign Creek
2. Land Use	2/4	timber harvest
3. NPS Pollution	7/8	sediment in stream may ? be attributable to logging
4. Bank Stability	9/12	unconsolidated banks, substantial chan. migration
5. Substrate Composition	15/20	riffles < 1/3, runs 1/3-2/3
6. Channel Stability	8/16	chan migration with associated scour
7. (Streamside Veg.)	-	
- % bare ground	3/4	15-30% bare ground
- avg. width veg. zone	4/4	
- use or damage	3/4	high water damage
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: **Granite Creek**

Granite Creek begins at the confluence of Dodge and Cyclone Creeks and flows 7.8 miles south to the confluence with the Middle Fork of the Flathead River. Granite Creek has been divided into two reaches (I - II) beginning at the River. Average gradient in reach I is approximately 2 percent and close to 1 percent in reach II. The channel generally meanders through a broad (200") floodplain consisting of sand and coarse gravels. Land management activities are confined to reach II and consist of logging and roading. Backcountry use is the only human activity in reach I. Specific conditions or problems observed by the surveyor are listed below.

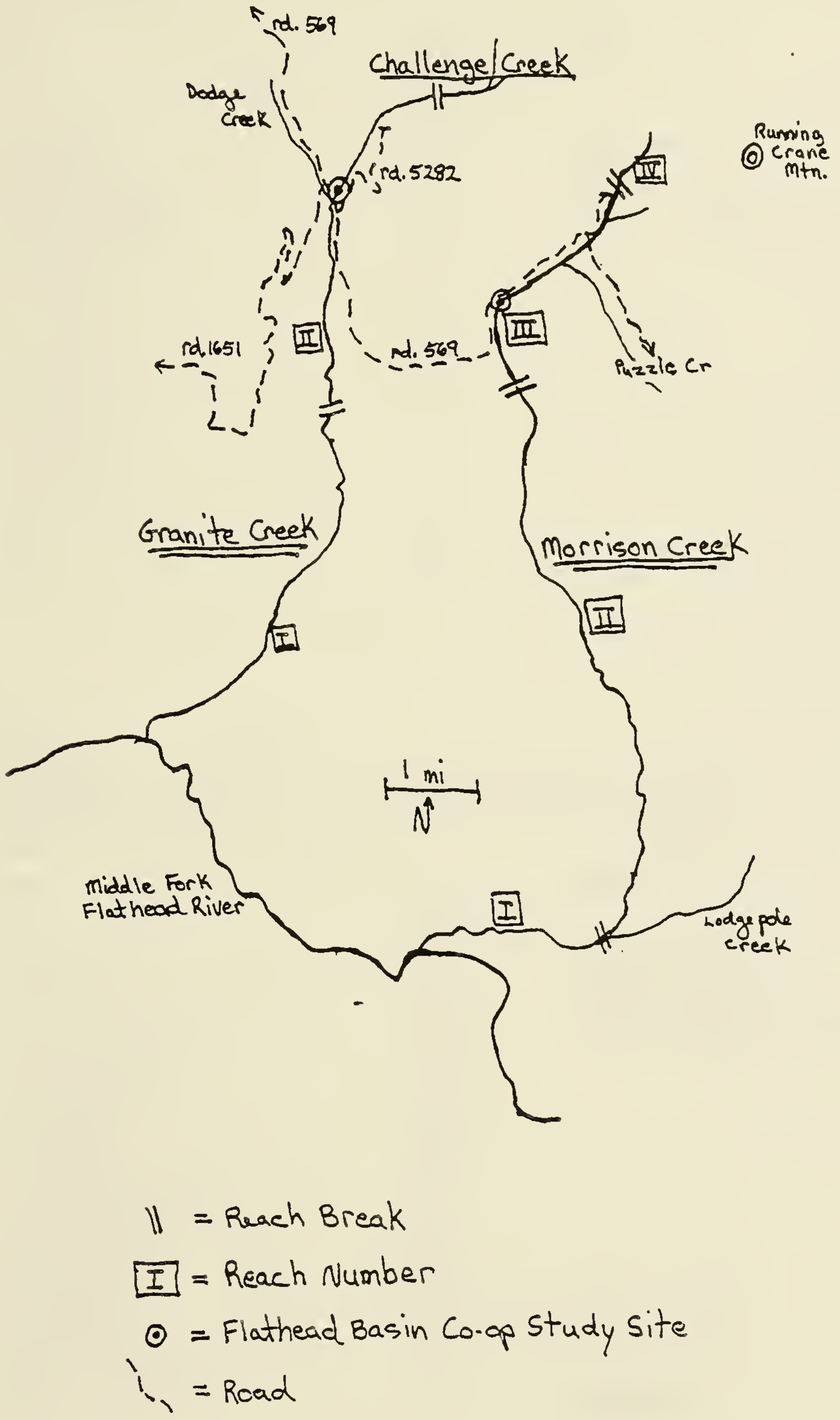
Reach I

Damages from the 1964 flood are more obvious in this reach than in reach II. The channel is composed primarily of bare cobble and sands. Most of the banks are 1 - 3' high and eroding. Considerable channel instability exists in this reach. At least ten raw banks >50' high by >100' long were observed adjacent to the floodplain or near the stream on tributaries. These banks consist of fine erodible soils and probably contribute sediment to Granite Creek.

Reach II

Natural debris jams are abundant in this reach. The jams are causing bank erosion, channel scour and channel braiding. Debris was also observed outside the present channel and likely the result of the 64' flood. An exceptionally large debris jam at the downstream end of this reach may catch debris that would otherwise be transported into reach I. A cutting unit located on road 1651 in section 1 may contribute sediment to the unnamed tributary that enters Granite from the west in section 6. Sediment is contributed to Sign Creek (a tributary of Granite Creek east of road 569) by a natural mass wasting bank. Washouts from road 569 contribute sediment to tributaries in section 6. The unnamed tributary that enters Granite Creek from the east near the downstream end of section 6 appears to be blownout. The unstable channel conditions could be the result of runoff from road 569. Road erosion was evident on road 9634 near the junction with rd. 569 and also at the Dodge Creek crossing on road 1651. Sediment is contributed to Dodge Creek at this crossing however, sedimentation to Granite is unlikely from the erosion on road 9634.

GRANITE, CHALLENGE and MORRISON CREEKS



STREAM NAME: **HAND CREEK**
REACH NUMBER: 1
REACH IDENTIFICATION: Sec.03NE., T.29 N., R.25 W. to Sec.32SE., T.30 N., R.25 W.. (confluence with Griffin creek to South Fork Hand Creek)

RATING: 91% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	logging
3. NPS Pollution	6/8	logging slash & litter
4. Bank Stability	12/12	
5. Substrate Composition	10/10	riffles < 1/3 embedded
6. Channel Stability	22/24	minor pool filling and chan, braiding
7. (Streamside Veg.)		
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	6/8	beaver activity
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	-	
13. Foreign Debris	2/8	litter and logging slash on banks and in channel
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)		
- fish	1/3	fish present
- plants	-1/3	abnormal amount of moss

STREAM NAME: **HAND CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.32 SE., T.30 N., R.25 W. to Sec.6 NE., T.29 N., R.25 W.. (confluence with S. Fork Hand to confluence of unnamed 2nd order trib. in north-central portion of section 6)

RATING: 92% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	logging >10 years old
3. NPS Pollution	6/8	old bridge logs in stream
4. Bank Stability	12/12	
5. Substrate Composition	9/10	riffles <1/3 embedded
6. Channel Stability	22/24	pools have light dusting of sed.
7. (Streamside Veg.)	19/19	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/4	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	cut logs in stream
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	2/3	fish common
- plants	-1/2	excessive moss

STREAM NAME: **HAND CREEK**
REACH NUMBER: III
REACH IDENTIFICATION: Sec.6 NE., T.29 N., R.25 W. to Sec.1 SE., T.29 N., R.26 W.. (confluence of unnamed trib. N.-central sec. 6 to headwaters)

RATING: 91 % = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	logging (>10yrs.) adjacent to stream
3. NPS Pollution	6/8	minor amnts. of logging slash in channel and old skid trail is gullied
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	21/24	chan. braiding due to slash in logged areas
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	2/4	slash and debris causes some chan. braid
9. Turbidity	N/A	no water
10. Water Surface Oil	N/A	no water
11. Precipitates	N/R	no water
12. Salinization	N/A	
13. Foreign Debris	3/8	old logging slash
14. Water Odor	N/A	no water
15. Dewatering	2/8	no water, intermittent stream
16. (Aquatic Organisms)	N/A	no water
- fish		
-plants		

NARRATIVE DESCRIPTION OF STREAM FEATURES ON HAND CREEK

This narrative description of stream features on Hand Creek begins at the water quality monitoring station established at an old road crossing in section 6 by the Flathead National Forest. In a small clearing above the water quality site is an electronic snow measurement site (SNOTEL) maintained by the Soil Conservation Service and a snow survey course that runs parallel to the stream.

For the first one-eighth mile above the monitoring site Hand creek runs through a thick, brushy spruce bottom. The channel bottom is composed of course gravels and rocks with fine sediment and organic materials accumulated in low velocity areas. The soil is saturated and spongy well beyond the channel's defined boundary.

Directly above this stretch the stream channel completely disappears at edge of an old cutting unit that was originally logged in the 1960's and salvage cut in the early 1980's. The previously preferred or established stream channel has been transected numerous times by equipment and/or skid trails; it exists now as deep water holes with floating mats of vegetation, or as water running down tracks. Rills have formed in the ruts and the surrounding soils are characterizic of those that are saturated nearly yearlong. Erosion is several inches to more than a foot deep in places, then the water completely disappears again. The area appears to act as a collection point or sink for all water that enters into it from the watershed above and as a settling or filtration zone for any sediment that is transported to this point.

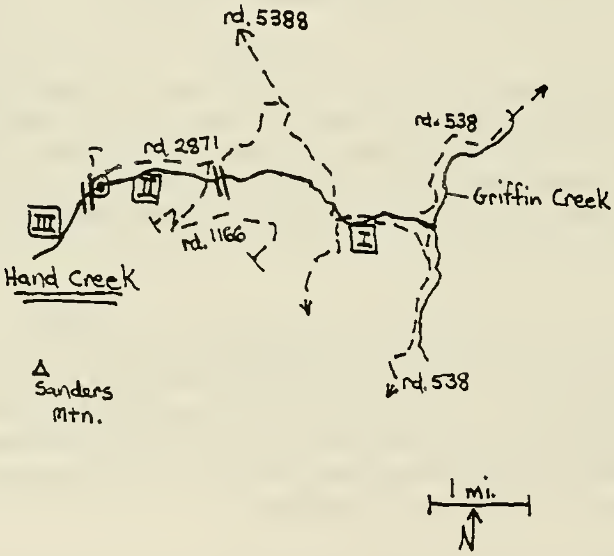
Above the meadow/bog/partial-cut area Hand Creek runs down a "V" shaped drainage. There is an old road bed that runs parallel to the streambed for several hundred feet. The preferred channel crisscrosses this old road with the water running down the road as often as it runs down any "natural" channel. Above the obvious road bed corridor is a trail that continues along the bottom nearly to the headwaters. Again the preferred course of the stream is directly down the trail as often as down its nature bed. Erosion is occurring along both the trail and road section (rills several inches deep and more that a foot wide in places), but it appears that all of the transported sediment settles out where Hand Creek flows through the meadow or bog area.

Cutting units logged in the mid 1980's for the "Sanders Hand" timber sale were surveyed for potential sediment sources. Of the three units that are located within this watershed only one is in a close proximity to the live stream. It was given a sufficient streamside management zone but many of the leave trees have blown down into a tangled gnarl at the edge of a rock outcrop that is the unit's lower boundary. The road constructed in the early 1980's to access these units did show signs of active erosion along the ditches but all culverts that were checked emptied onto areas that had heavy vegetation, effectively filtering sediment transported by runoff before it could reach the stream.

A new road is presently being pioneered into private land in the southwest corner of the watershed. This area has an intermittent tributary running though it which flows partly above and partly below the surface. There should be no danger of damage to this tributary unless a very large volume of runoff is concentrated into its limited channel capacity.

A Channel Stability Survey conducted in July 1990 evaluated Hand Creek in the reach upstream from the water quality monitoring station. This section rated "good" (76). It should be noted that a score of 75 is only 2 points from the next lower rating "fair". There were no historic stability ratings available to compare with the current conditions so it is not possible to determine if this borderline score could indicate an improvement or a deterioration. No rating was attempted in the meadow/bog/partial-cut area because there was no continuous section of stream channel long enough to evaluate the criteria necessary to do a realistic rating.

HAND CREEK



\\ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

╎ = Road

STREAM NAME: **HUNGRY HORSE CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.21SE., T.30 N., R.18 W. to Sec.23NW., T.30 N., R.18 W.. (mouth at Hungry Horse Reservoir to confluenc of Tiger Creek)

RATING: 85% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1.5/4	timber harvest > 10 years old, roads
3. NPS Pollution	7/8	instream sediment possibly from road
4. Bank Stability	9/12	moderate vertical & slump eros., 10-20%
5. Substrate Composition	19/20	runs are slightly embedded in some locations
6. Channel Stability	12/16	annual chan. migration, pools dusted with sed.
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	debris may contribute to chan. migration
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	6/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **HUNGRY HORSE CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.23NW., T.30 N., R.18 W. to Sec.25SE., T.30 N., R.18 W.. (confluence with Tiger Creek to road #1048 crossing Sec. 25)

RATING: 83% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest, roads
3. NPS Pollution	6/8	road sediment (rd. 1048 crossing Sec. 25)
4. Bank Stability	12/12	
5. Substrate Composition	13/20	riffles avg. 1/3+, runs=1/3-2/3 embedded
6. Channel Stability	13/16	minor pool filling, instability near rd 38 crossing Sec. 25
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3.5/4	rip rap could be a barrier to small fish
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	6/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	2/2	

STREAM NAME: **HUNGRY HORSE CREEK**
REACH NUMBER: III
REACH IDENTIFICATION: Sec.25SE., T.30 N., R.18 W. to Sec.29NW., T.30 N., R.17 W.. (road #1048 crossing, Sec. 25 to falls, Sec. 29NW)

RATING: 99% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	19/20	
6. Channel Stability	16/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: **Hungry Horse Creek**

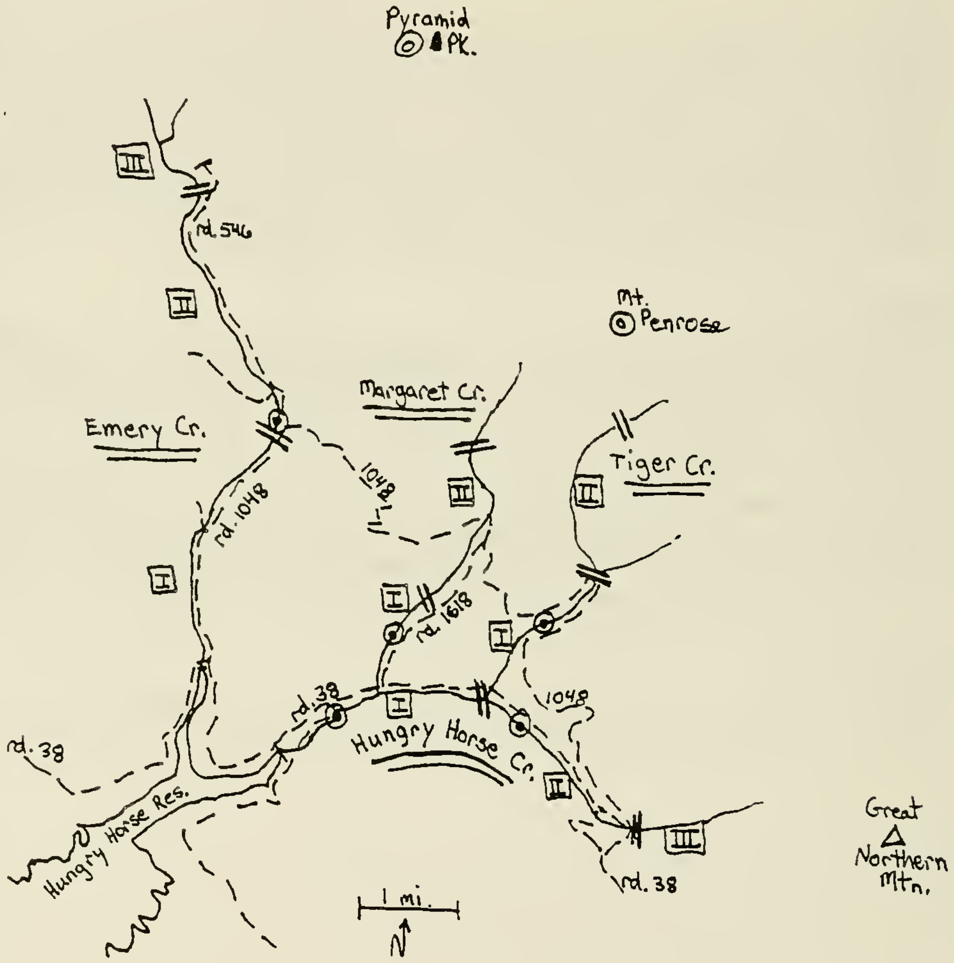
Hungry Horse Creek flows westerly from the west side of Great Northern Mountain for approximately six miles to Emery Bay on Hungry Horse Reservoir. This stream was divided into three reaches (I - III). Gradient in reach I and II ranges between 1 and 3 percent while reach III averages greater than 3 percent and up to 24 percent. Management activity (roading and logging) occur in reach I and II only. Specific conditions or problems observed by the surveyor are listed below.

Reach I
This reach begins at Tiger Creek and continues to Hungry Horse Reservoir. The channel is fairly broad with evidence of channel migration especially around debris jams. Eroding banks 1 -3 feet high are common at channel bends and probably contribute sediment during high flow. The substrate consists of small cobble and gravels and riffle embeddedness was estimated at less than 1/3. Pools are filling with sediment. Logging units and roads occur throughout the reach however, no related stream problems were observed.

Reach II
Stream banks are generally stable and well vegetated. Substrate in this reach is dominated by cobble with a subdominant mixture of gravels and small boulders. Substrate embeddedness was estimated at 1/3 to 2/3's. Channel braiding and sediment deposition was observed below the bridge on road 1048. Bridge construction may have been the cause of these conditions. Channel braiding occurs at many other areas in this reach as well. A culvert near the road 1048 bridge in section 25 is plugged and causing road surface erosion. A raw cutbank adjoining the ditch with the plugged culvert erodes into the ditch and across the road. Both erosion sources potentially transport sediment to the stream.

Reach III
This reach is quite steep. The substrate is primarily large cobble and boulders. Banks are well vegetated and stable. No natural erosion was observed.

EMERY, MARGARET, TIGER, HUNGRY HORSE CREEKS



‖ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

- - = Road

STREAM NAME: **JIM CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.21 SW., T.22 N., R.17 W. to Sec.32 NW., T.22 N., R.17 W.. (confluence with Swan River to road # 888 crossing)

RATING: 73% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	logging (old) up to stream, residential, grazing
3. NPS Pollution	6/8	old logging slash, sediment?
4. Bank Stability	12/12	
5. Substrate Composition	21/30	slow water areas (pools, runs) are sedimented naturally?. Riffles appear to be <1/3 embedded
6. Channel Stability	8/16	moderate deposition with pools decreasing in size and reduced channel capacity
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	blowdown and past logging
- stream shading	2/4	25 - 50% shading
- sed. filtering capacity	3/4	
8. Channel Modifiers	N/R	debris jams have trapped a lot of sediment and decreased channel capacity
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	3/4	black organics
12. Salinization	N/A	
13. Foreign Debris	1/8	logging slash common in lower reach
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	fish present
- plants	2/2	

STREAM NAME: **JIM CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.32 NW., T.22 N., R.17 W. to Sec.31 SW., T.22 N., R.17 W.. (road #888 crossing to unnamed ephemeral trib. sec. 31 SW.)

RATING: 89% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	8/10	
6. Channel Stability	10/16	deposition of fines behind velocity breaks
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	N/R	

STREAM NAME: JIM CREEK
REACH NUMBER: III
REACH IDENTIFICATION: Sec. 31 SE., T.22 N., R.17 W. to Sec.6 NE., T.21 N., R.17 W.. (confluence with unnamed trib. sec. 31 SW. to approx. 1/3 mi. downstream of W. Fk. Jim)

RATING: 79% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	2/4	recent harvest w/in 200' of chan. also evidence of old harvest <50' from channel
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	N/R	depositional reach (beaver ponds)
6. Channel Stability	8/16	moderate deposition, pool size and chan. capacity is reduced
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	
- stream shading	2/4	25 - 50% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	normal plant growth

STREAM NAME: JIM CREEK
REACH NUMBER: IV
REACH IDENTIFICATION: Sec.6 NE., T.21 N., R.17 W. to Sec.18 SW., T.21 N., R.17 W.. (approximately 1/3 mi. downstr of W. Fk. Jim to canyon sec. 18 SW)

RATING: 83% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	2/4	recent logging averages 50 - 200' from channel. Road crossing
3. NPS Pollution	4/8	road erosion in section 7
4. Bank Stability	12/12	
5. Substrate Composition	17/20	riffles avg. 1/3 embedded, pool substrate up to 25% fine sediment
6. Channel Stability	12/16	some scour and deposition present, minor pool filling
7. (Streamside Veg.)	-	
- % bare ground	3/4	depaperate ground cover in places
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	flow deflectors (debris) cause minor bank eros.
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	6/8	slash pile near stream in sec. 7
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	no fish observed
- plants	2/2	

STREAM NAME: JIM CREEK
REACH NUMBER: V
REACH IDENTIFICATION: Sec.18 SW., T.21 N., R.17 W. to Sec.13 SW., T.21 N., R.18 W.. (canyon sec. 18 SW to 1/8 mi. downstr. of stream forks and old road # 9S68?)

RATING: 100% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	4/4	no activities
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	16/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	fish present
- plants	2/2	

STREAM NAME: JIM CREEK
REACH NUMBER: VI
REACH IDENTIFICATION: Sec.13 SW., T.21 N., R.18 W. to Sec.14 NE., T.21 N., R.18 W.. (1/8 mile down stream of stream forks and old road #9S68? to lower Jim Lake)

RATING: 82% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	1/4
2. Land Use	1/4	older timber harvest
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	9/10	riffles slightly embedded
6. Channel Stability	12/16	some point bar formation and minor pool filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	majority of overstory removed by logging
- stream shading	1/4	<25% stream shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	little or no woody debris in this reach
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	-1/2	excessive algal growth, potentially related to temp. and sunlight from canopy removal and lake

STREAM NAME: JIM CREEK
REACH NUMBER: VII
REACH IDENTIFICATION: Sec.14 NE., T.21 N., R.18 W. to Sec.10 SE., T.21 N., R.18 W.. (lower Jim Lake to lower lake in Jim Lakes Basin)

RATING: 96% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	roads and recreational use 50 - 200' from stream
3. NPS Pollution	8/8	minor amount of litter from campers
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	16/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	average shading = 51 - 75%, but variable
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **WEST FORK JIM CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.6 SE., T.21 N., R.17 W. to Sec.7 NW., T.21 N., R.17 W.. (mouth, confluence with Jim Creek to just inside of section 7)

RATING: 93% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	3/4	logging >200' from channel
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	12/16	a short low gradient section in the lower reach exhibits some bar formation and light pool deposition
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	

STREAM NAME: **WEST FORK JIM CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.7 NW., T.21 N., R.17 W. to Sec.12 SE., T.21 N., R.18 W.. (edge of logging unit, just inside section 7 to just inside, East side of section 12)

RATING: 67% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	recent logging <50' from channel
3. NPS Pollution	4/8	sediment from road erosion, slash in channel, litter
4. Bank Stability	9/12	moderate bank disruption due to blow down
5. Substrate Composition	9/10	riffles <1/3 embedded
6. Channel Stability	10/16	upper portion of reach is lower gradient and depositional, pools are filling. Lower reach is high gradient with little or no deposition
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	2/4	25 - 50', but variable
- use or damage	2/4	substantial blowdown
- stream shading	2/4	25 - 50% shading
- sed. filtering capacity	2/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash and litter in stream
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	no fish observed
- plants	2/2	normal plant growth

STREAM NAME: **WEST FORK JIM CREEK**
REACH NUMBER: **III**
REACH IDENTIFICATION: Sec.12 SE., T.21 N., R.18 W. to Sec.12 SW., T.21 N., R.18 W.. (East side of section 12 to West side of section 12)

RATING: 87% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	16/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	
9. Turbidity	8/8	
10. Water Surface Oil	N/R	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

NARRATIVE DESCRIPTION OF STREAM FEATURES ON JIM CREEK

This narrative description of stream features Jim Creek begins at the bridge of road 888. When this area was first visited in June 1990 spring runoff was still occurring. Water was flowing through streamside vegetation above and below the bridge, six to twelve inches deep. A small slump (6" x 5') was evident on the southwest side of the bridge abutment. Active erosion was occurring due to the constriction caused by the bridge during high flow. The Yellow Bay sampling station is down stream from this point approximately 150' where the stream is approximately 50 feet wide with little vegetative cover.

Up stream from the bridge crossing Jim Creek flows through a moderately dense stand of spruce, cedar and larch. Blown down trees are present through the lower half mile of stream and accumulations across the stream are considerable in places. Large spruce root wads have been exposed along the active stream channel; these should be considered as a natural source of sediment. Deposits of fine sediment were noted in still water areas especially near the blowdown concentrations. A few old stumps and evidence of an old skid trail were noted in this lower section but there is no evidence of recent harvesting.

Forest Service cutting units in section 12 were accessed via road 10388 and surveyed for potential sediment sources. Some erosion was evident on several skid trails in units from the "Jim Creek - Fatty Creek 1" timber sale and along roadside ditches. It appeared that water bars constructed to prevent erosion had not distributed runoff effectively. It is not known whether the erosion controls failed after the original harvest or if the water bars were not reconstructed after additional logging occurred in this section to remove blow down. At the time of this survey it looked as if upslope erosion had contributed to the partial wash out of a culvert that facilitates a tributary of Jim Creek in the southwest corner of section 12. In other places culverts along road 10388 were not placed close enough to prevent accumulations of water from eroding the ditch but most emptied into vegetated draws and were not considered a potential sediment source to Jim Creek. New road construction at the end of this road did not have sufficient water drainage to avoid ditch or surface erosion but vegetation below the road appeared to be catching sediment before it could enter any live stream course.

Plum Creek Timber Co. cutting units were also surveyed for potential sediment sources. The west facing slope of section 7 was harvested in 1988. A narrow (5 to 20 feet wide) streamside management zone left along the main channel on Jim Creek has blown down across the stream. As of August 1990 approximately 30 to 50 percent of this leave strip has blown down. The haul road that parallels the stream showed signs of active erosion and recent reworking. Out-sloped sections and drainage dips were located so that any sediment transported is trapped in slash or dense vegetation before it can reach the live stream, but these locations were in very close proximity to the stream in some cases (within 15 feet). The east facing slope of the stream was in the process of being logged during this survey and was not reviewed. The stream channel through this area is narrow (5 to 10 feet wide) and flows over well rounded rocks and boulders. It is migrating into pockets left by the upturned roots of blowdown and shows some new gravel accumulations.

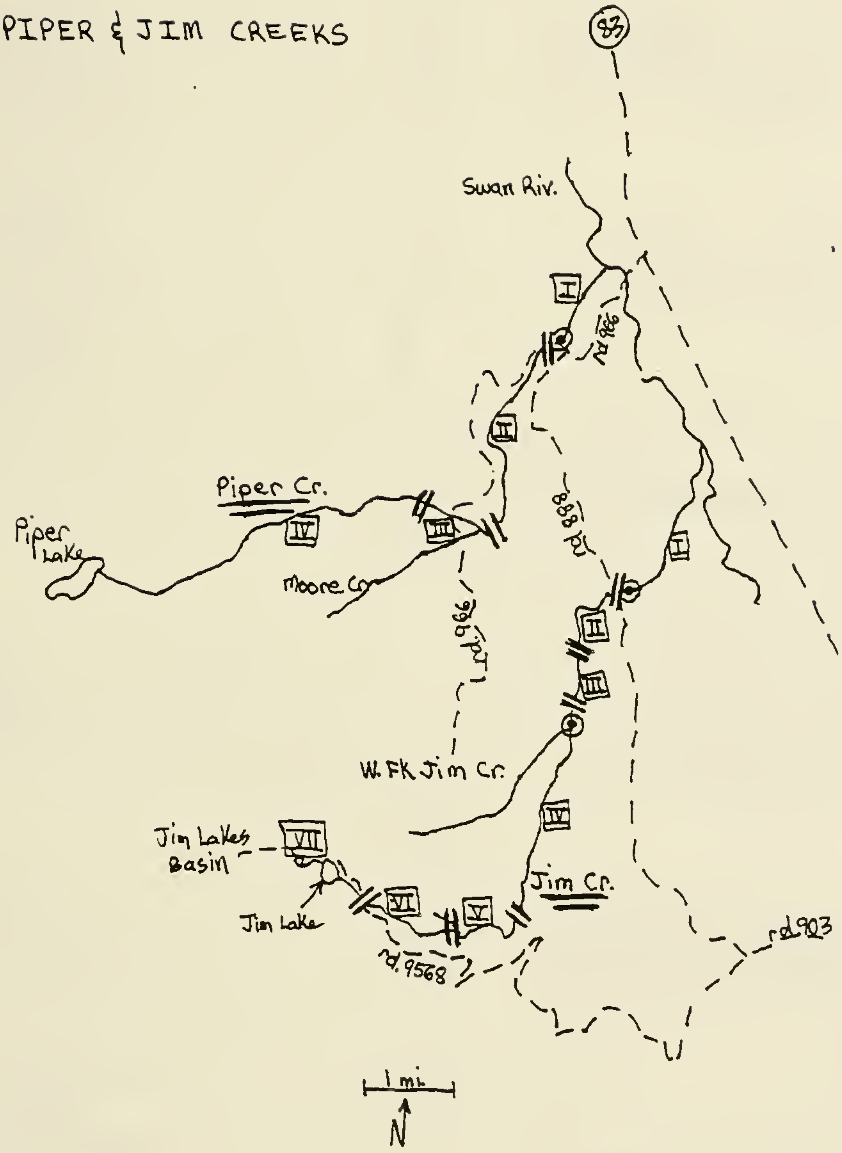
The valley bottom in section 13 was logged in 1980 and little or no stream side vegetation was left. A few spruce that were retained along the stream bank have blown down and some active erosion is occurring. Small sloughs and cut banks were noted. In section 14 road 9568 has drained directly into Jim Creek during spring runoff and intense rain events. At this point a drainage dip has been placed so that it routes the surface runoff onto an old drive-through on the upstream side of the bridge. Rilling was noted on the road and on the old ruts of the equipment crossing.

Cutting units in section 11 were logged in the early 1980's and are mostly revegetated. The area did show extensive erosion in gullies and along some road surfaces. One such site is located above the switch-back where road 9568 is closed for wildlife protection. Accumulated water has washed sediment and fine gravels across both this road and the lower road, then into the primitive camp site on the edge of the lake. Sediment from this site has undoubtedly reached the lake on occasion but anything contributed to the water course at this point or above would not be transported to the stream below because it would settle out of suspension in the lake. The stream channel feeding into this lake is composed of large rocks and gravels. It does show some signs of active cutting and a small delta accumulation was evident where the stream enters the lake, but as stated before, it is highly unlikely that any sediment added to this lake would be measured at a monitoring station on road 888. The area could benefit from the installation of erosion controls and/or sediment traps on skid trails and in gullies that are currently eroding.

The upper limits of Jim Creek are in the Mission Mountain Wilderness. Any natural sediment contributions from this basin would be systematically removed from transport by a series of lakes.

A Channel Stability Survey, conducted on September 6, 1990, evaluated the reach above the road 888 bridge as "fair" (81). This value represents the conditions of the stream from the bridge to where Jim Creek crosses into section 31. A survey conducted on 8/3/83 by the Montana Department of Fish Wildlife and Parks, in conjunction with the Swan River Study, rated this section of stream as "good" (69). It should be noted that a score of 77 is the breaking point between "good" and "fair". The change between the ratings would probably not be considered statistically significant because the increase is relatively small compared to the broad range of each category. (Each category represents a value range of about forty points.)

PIPER & JIM CREEKS



‖ = Reach Break

☐ = Reach Number

⊙ = Flathead Basin Co-op Study Site

╌ = Road

STREAM NAME: **LION CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.8 NW., T.22 N., R.17 W. to Sec.9 SE., T.22 N., R.17 W.. (mouth at confluence with Swan River to section 9 and 10 line)

RATING: 79% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest in some cases up to stream
3. NPS Pollution	6/8	slash in stream
4. Bank Stability	8/12	large eroding banks below highway 83
5. Substrate Composition	10/10	
6. Channel Stability	18/24	primarily rated for deposition and channel braiding below highway 83
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51 -75% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	2.5/4	debris jams near mouth trap sediment and cause channel braiding
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	logging slash in channel
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	aquatic plant growth normal

STREAM NAME: **LION CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.9 SE., T.22 N., R.17 W. to Sec.13 NW., T.22 N., R.17 W.. (section line, sections 9 & 10 to approx. 1/8 mi. E. of section 13 line)

RATING: 68% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	logging >10 years old
3. NPS Pollution	6/8	occassional cut logs in channel
4. Bank Stability	9/12	bank disruption due to blowdown
5. Substrate Composition	1/10	riffles are highly (>2/3) embedded
6. Channel Stability	11/16	some scour and moderate deposition, pools are filling and decreasing in size
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	blowdown
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	heavy debris loading in this reach causes some scour and excessive deposition. Most debris appears stable
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	none observed
- plants	2/2	

STREAM NAME: **LION CREEK**
REACH NUMBER: III
REACH IDENTIFICATION: Sec.13 NW., T.22 N., R.17 W. to Sec.10 SW., T.22 N., R.16 W.. (approx. 1/8 mile E. of sec. 13 line to just inside sec. 10 SW.)

RATING: 74% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	9/12	debris causes flow deflection and moderate undercutting
5. Substrate Composition	20/30	riffles and runs 1/3 - 2/3 embedded, pools are dominated by fines
6. Channel Stability	8/16	channel braiding and point bars common, pools are filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	old timber stand decadence (blowdown)
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	1/4	high debris loading causes excess deposition and channel instability
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **LION CREEK**
REACH NUMBER: IV
REACH IDENTIFICATION: Sec.10 SW., T.22 N., R.16 W. to Sec.26 SE., T.23 N., R.16 W.. (just inside section 10 SW. to headwaters section 22)

RATING: 95% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	none observed
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	21/24	light deposition in pools, channel braiding present
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/4	4/4
8. Channel Modifiers	3/4	debris may cause channel instability with high flows
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

NARRATIVE DESCRIPTION OF STREAM FEATURES ON LION CREEK

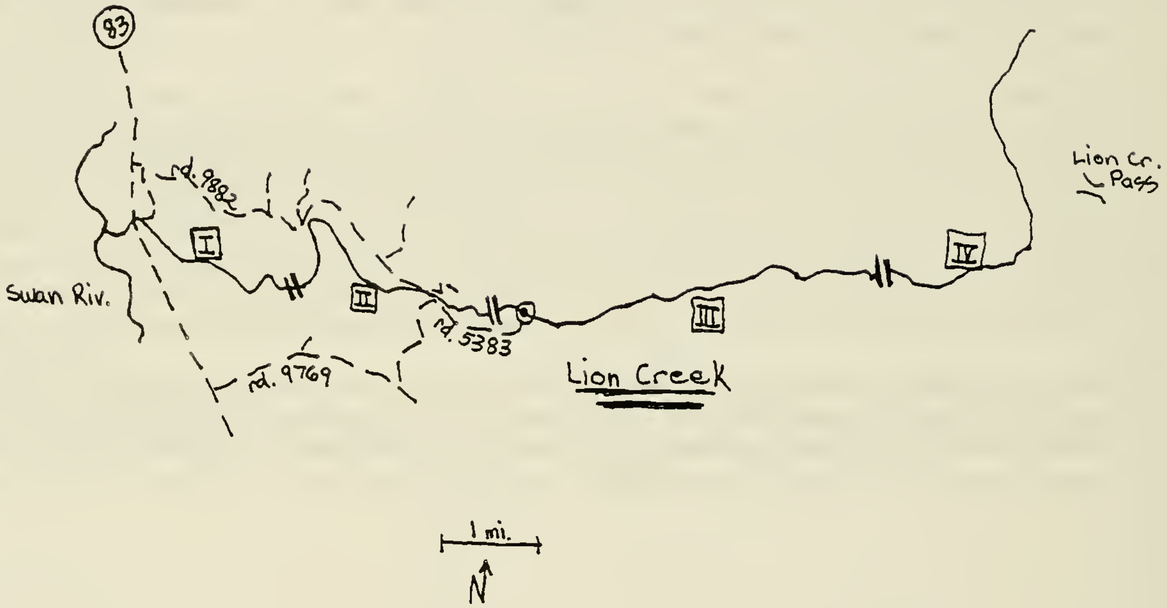
This narrative of stream characteristics begins at the water quality monitoring station established by the Flathead National Forest in section 13. At this location there is a foot bridge spanning the stream, used to measure discharge during peak flow periods. The banks show evidence of heavy use, i.e. paths along the banks and patched where all vegetation is gone. This is probably partially attributable to the packer camp that is also located at this point. The bank on the upstream, south side of the foot bridge has unraveled, creating a slump that measures 9 feet by 6 feet. Fine sediment has entered the water from this point during high flow and precipitation events and is accumulating at the toe of the slump. The Yellow Bay Biological Station has established a monitoring station downstream from this location.

The reach above the monitoring station is cluttered with large woody debris in several locations. At one point the debris is continuous across the total width of the stream and has collected great volumes of bedload. Point bars and pools are characterized by bright colored gravel deposits that move on a yearly basis. Blowdown in the channel is of varying ages and appears to be a key element in maintaining this stream's sediment storage capacity and a relative state of equilibrium.

A Stream Channel Stability Survey conducted September 6, 1990 rated this reach of stream as "fair" (89). A Survey conducted Flathead National Forest personnel in August 1988 along the same stretch also rated it as "fair" (105). The fine gravel composition of the majority of the stream bed, continuous natural accumulations of large woody debris, and constant channel cutting are the main factors that prevented this reach of Lion Creek from rating "good". A survey conducted by the Montana Department of Fish, Wildlife and Parks in October 1983 rated the lower portion of Lion Creek as "fair" (83) and evaluated the upper section as "good" (56). It is not possible to use these ratings as a direct comparison because the reaches surveyed by the state personnel encompassed many miles and were broken differently then the Forest Service surveys.

This is a primarily untouched watershed that is to be used as a "control" station. No harvest activity has occurred above the water quality monitoring station but it is used for recreation. The entire stream was not walked during this preliminary survey, but the lower portion did show some signs of use. It must be assumed at this time that the impacts are minimal and do not contribute to any significant stream degradation.

LION CREEK



‖ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

\ \ = Road

STREAM NAME: **MARGARET CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.22NW., T.30 N., R.18 W. to Sec.15NE., T.30 N., R.18 W.. (mouth at confluence with Hungry Horse Creek to road crossing Sec. 15)

RATING: 89% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest . 10 years old
3. NPS Pollution	7/8	litter
4. Bank Stability	12/12	
5. Substrate Composition	16/20	substrate cobble is shallow and underlayed by sand, gravels mixed with sand
6. Channel Stability	14/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	litter and old bridge logs
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish		
- plants	2/2	

STREAM NAME: **MARGARET CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.15NE., T.30 N., R.15 W. to Sec.2NW., T.30 N., R.18 W.. (lower road crossing, Sec. 15 to wilderness boundary)

RATING: 95% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest >10 years old
3. NPS Pollution	6/8	litter slash
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	16/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	litter, minor slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	2/2	

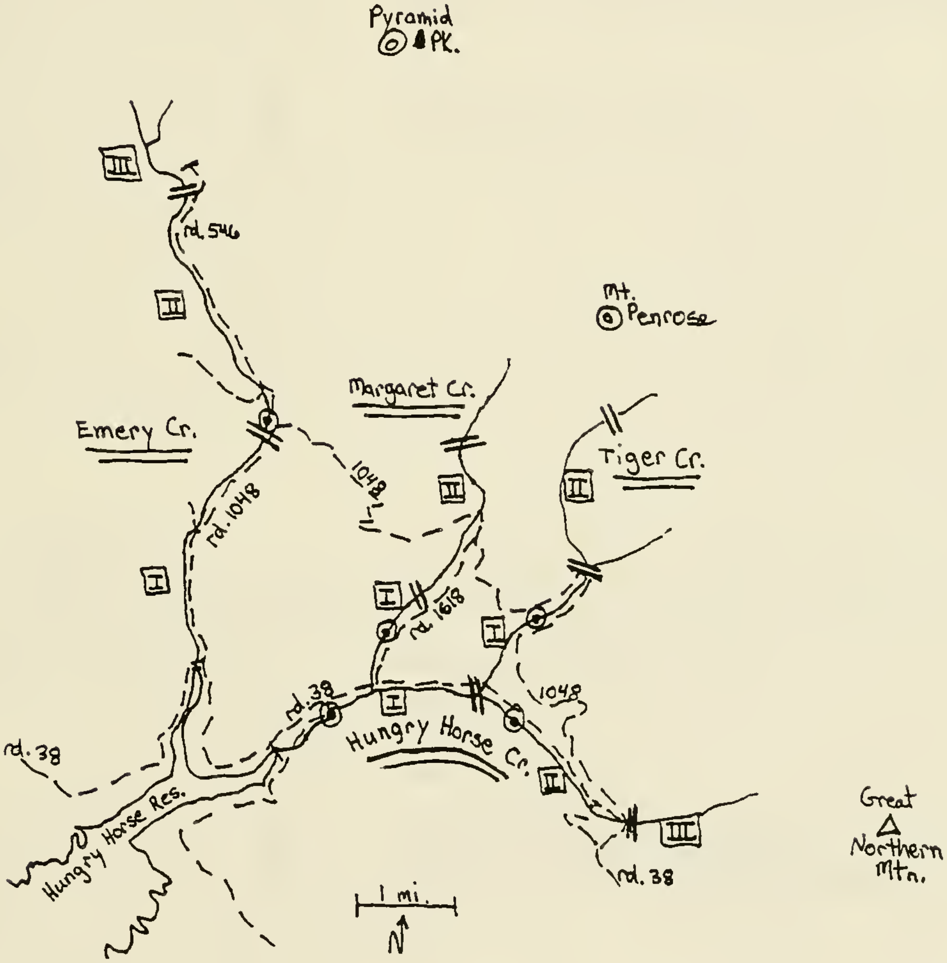
Stream Name: **Margaret Creek**

Margaret Creek flows south from the basin formed by Great Bear Mountain and Mount Penrose to its confluence with Hungry Horse Creek. Assessments were completed on approximately 3.3 miles of stream from the Great Bear Wilderness Boundary to the mouth. The stream was divided into two reaches (I - II) starting at the mouth. The stream is second order until the lower end of reach I where it becomes third order. Management activity (logging and roading) occurs in both reaches. Specific conditions or problems observed by the surveyor are listed below.

Reach I
Stream gradient is 1 to 3 percent, banks are stable and well vegetated. The substrate appeared to have low embeddedness except in locations of reduced current velocity were deposition was moderate. Debris jams were not common in this reach. Logging occurred in this reach and no related problems were observed. Minor channel erosion was observed below the road 38 culvert.

Reach II
Very steep gradient (up to 15 percent), boulders and cobble are the dominant substrate and banks are stable and well vegetated. Logging is common downstream of the crossing at road 1048, although two unit exist between the road and the wilderness boundary. Units upstream of the road were at least 10 years old and located adequate distance from the stream. Best management practices were applied to the lower units. No stream problems related to logging or roads were noted by the surveyor.

EMERY, MARGARET, TIGER, HUNGRY HORSE CREEKS



\\ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

⋱ = Road

STREAM NAME: **MORRISON CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.8SW., T.27 N., R.13 W. to Sec.10NE., T.27 N., R.13 W.. (mouth at confluence with Middle Fork Flathead to confluence with Lodge Pole Creek)

RATING: 66% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	2/4	large eroding slopes adjacent to high water mark
2. Land Use	4/4	minor recreational use
3. NPS Pollution	8/8	
4. Bank Stability	5/12	substantial vert. & slump erosion, unconsolidated alluvial material
5. Substrate Composition	15/20	riffles < 1/3 exept edges at 1/3-2/3, runs = 1/3-2/3 embedded
6. Channel Stability	12/24	alluvial flood plain channel migration common pools filling
7. (Streamside Veg.)	-	
- % bare ground	3/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	damage related to high floods
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	2/3	
8. Channel Modifiers	2.5/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	2/2	

STREAM NAME: **MORRISON CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.10NE., T.27 N., R.13 W. to Sec.9N3., T.28 N., R.13 W.. (confluence with Lodge Pole Creek to approx. 0.1 mi. down stream of 4wd road Sec. 9NE)

RATING: 75% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	2.5/4	large eroding slopes
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	8/12	vert. and slump erosion avg. >3'x>20'
5. Substrate Composition	16/20	riffles avg. <1/3 runs 1/3-2/3 embedded
6. Channel Stability	16/24	channel migration & bruiding present, pools filling
7. (Streamside Veg.)	-	
- % bare ground	3/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	2/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	minor amounts of slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **MORRISON CREEK**
REACH NUMBER: **III**
REACH IDENTIFICATION: Sec.9NE., T.28 N., R.13 W. to Sec.35NW., T.29 N., R.13 W.. (approximately 0.1 mi. downstream of 4wd road, Sec. 9 to end of road Sec. 35)

RATING: 75% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest
3. NPS Pollution	6/8	sed. in ephemeral tribs. related to logging
4. Bank Stability	9/12	moderate instability
5. Substrate Composition	22/30	riffles <1/3, runs 1/3-2/3 embedded, pool 30-40% full
6. Channel Stability	10/16	some channel migration and pool filling
7. (Streamside Veg.)	-	
- % bare ground	3/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shades
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash in stream
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **MORRISON CREEK**
REACH NUMBER: **IV**
REACH IDENTIFICATION: Sec.35NW., T.29 N., R.13 W. to Sec.26NE., T.29 N., R.13 W.. (end of road, Sec. 35 to headwaters Sec. 26)

RATING: 82% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	9/12	moderate high flow erosion evident
5. Substrate Composition	14/20	riffles = 1/3, runs 1/3-2/3 embedded
6. Channel Stability	11/16	pool filling related to scour and deposition
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	debris jams cause bank erosion with high flows
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: **Morrison Creek**

Morrison Creek drains south from the southwest side of Running Crane Mountain, 11.4 miles to its confluence with the Middle Fork of the Flathead River in the Great Bear Wilderness Area. This stream has been divided into four reaches (I - IV) beginning at the confluence with the river. The gradient averages 1 -3 percent in the first three reaches and increases to greater than 3 percent in reach IV. While back country recreation is the only human activity in reaches I and II, logging and roading activities have occurred in the upper reaches (III and IV). Specific conditions and problems observed by the surveyor are listed below.

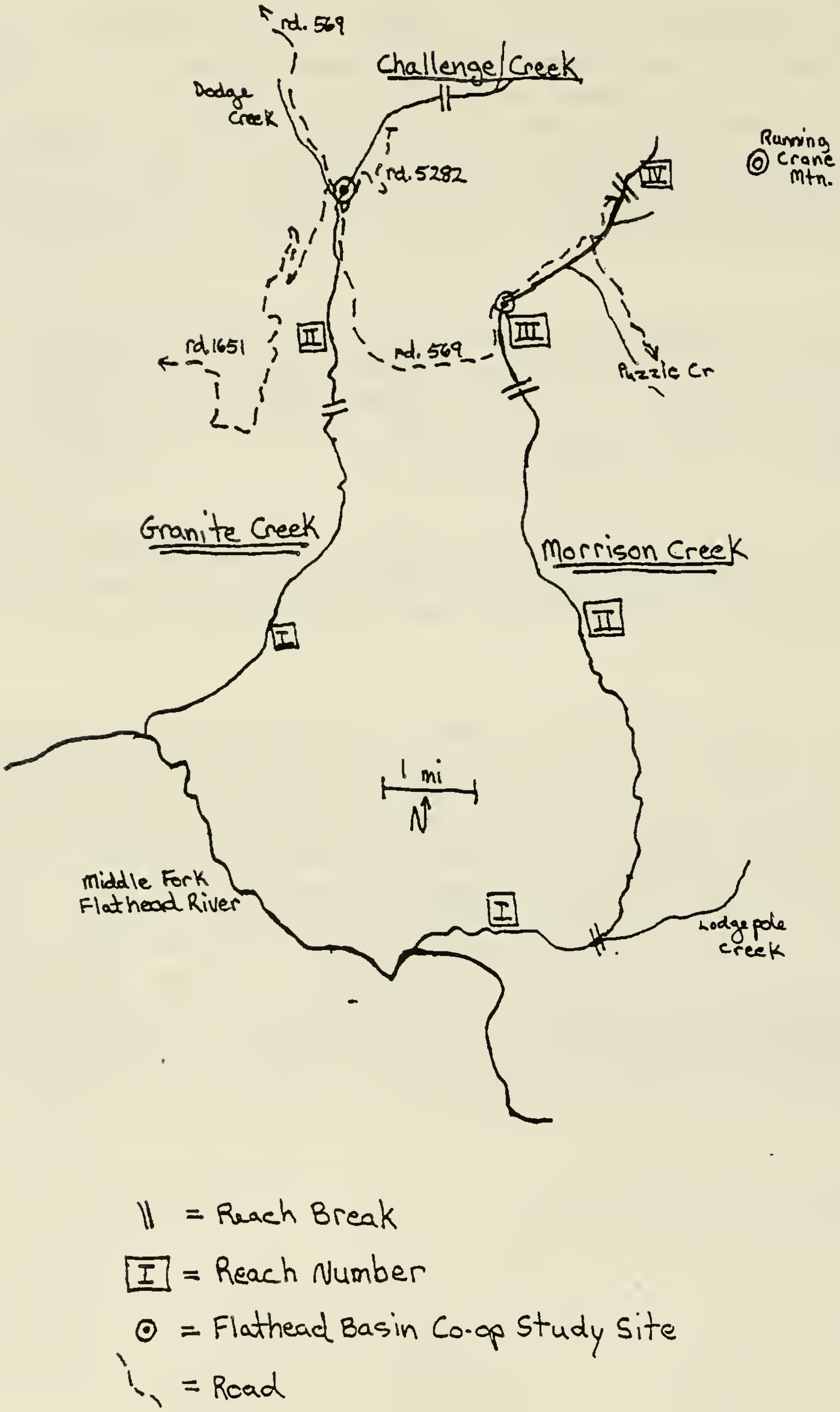
Reach I
Reach I begins at Lodgepole Creek where the stream channel doubles in size over reach II. Evidence of the 1964 flood is most evident in this reach. There is a broad unstable floodplain made up of loose cobble and gravel with scattered willow. The channel is incised 2 -3 feet and debris jams, though uncommon, deflect currents and cause bank erosion.

Reach II
Stream channel stability improves in reach II. Raw banks adjacent to the channel, 50 - 75' high by 200 - 300' long are common in this reach. Since there is no vegetational filter below these banks gully and rill erosion contribute sediment to the stream.

Reach III
The substrate consists primarily of small gravel, cobble, and small boulders. Pools are 30 - 40 percent filled by sands and channel edges embedded. Bedload deposition out of the present channel represents channel erosion caused by the 1964 flood. This reach contains the majority of management activity. Debris jams consisting of blowdown and logging slash cause channel erosion in section 4. Narrow streamside management zones and/or inappropriate harvest prescriptions have contributed to the blowdown problems particularly in the SW 1/4 of section 4. Cutting units in this area are located on very steep terrain and have a high potential to contribute sediment to the stream. In other areas of section 4 cutting units cross seeps that have no SMZ protection. In several areas these seeps are intercepted by road 569 and causing road surface erosion. Near Puzzle Creek, road erosion has clogged ditch culverts and caused gullying across the road surface which contributes sediment to the stream.

Reach IV
Narrative not available.

GRANITE, CHALLENGE and MORRISON CREEKS



STREAM NAME: OLE CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.14NE., T.29 N., R.16 W. to Sec.7SE., T.29 N., R.15 W.. (mouth at confluence with Middle Fork Flathead River to .4 miles into Sec. 7)

RATING: 71% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	3/4	eroding banks adjacent to stream upper portion of reach, side tribs. eroding
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	5/12	slumping banks, size >3' x >20'
5. Substrate Composition	11/20	riffles = 1/3 runs = 1/3-2/3 habitat appears impaired
6. Channel Stability	11/16	shifting substrate and chan. at confluence with river
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	absence of debris
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: OLE CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.7SE., T.29 N., R.15 W. to Sec.3NE., T.29 N., R.15 W.. (.4 mi into Sec. 7 to Elk Mt. trail x-ing)

RATING: 54% = severe impairment, (non-support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	1/4	large eroding banks in side drainage and adjacent to stream
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	2/12	severe vertical and slumping erosion, avg. size >3' x >20'
5. Substrate Composition	11/20	riffle avg. 1/3, run 1/3-2/3 embedded
6. Channel Stability	8/24	shifting channel in unstable alluvium
7. (Streamside Veg.)	-	
- % bare ground	2/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	erosive damage
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	down trees disrupt bank, cause sed. Also provide diversity by creating pools
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	fish present
- plants	2/2	

STREAM NAME: OLE CREEK
REACH NUMBER: 111
REACH IDENTIFICATION: Sec.3NE., T.29 N., R.15 W. to Sec.28SW., T.30 N., R.14 W.. (Fielding cabin trail x-ing to Sec. 28 line .2 miles before trail x-ing)

RATING: 56% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	1/4	tribs. and banks adjacent to Ole Cr. severely eroded
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	3/12	alluvial valley bottom, unstable stream banks
5. Substrate Composition	11/20	riffles = 1/3, runs = 1/3-2/3 embedded, habitat impaired
6. Channel Stability	8/24	unstable alluvium continual chan. shift
7. (Streamside Veg.)	-	
- % bare ground	3/4	15-30% bare ground
- avg. width veg. zone	4/4	
- use or damage	3/4	erosive damage
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	bank disruption from blow down, overall add habitat diversity
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: Ole Creek

Ole Creek is located entirely in Glacier National Park where backcountry use is the only human activity. Ole Creek is divided into three reaches, approximately 8 miles were assessed from its confluence with the Middle Fork of the Flathead River to just upstream of the Fielding Station trail crossing. An unstable stream channel, erosive geology and avalanche activity contribute to stream problems identified by the observer. Specific conditions and problems observed by the surveyor are listed below.

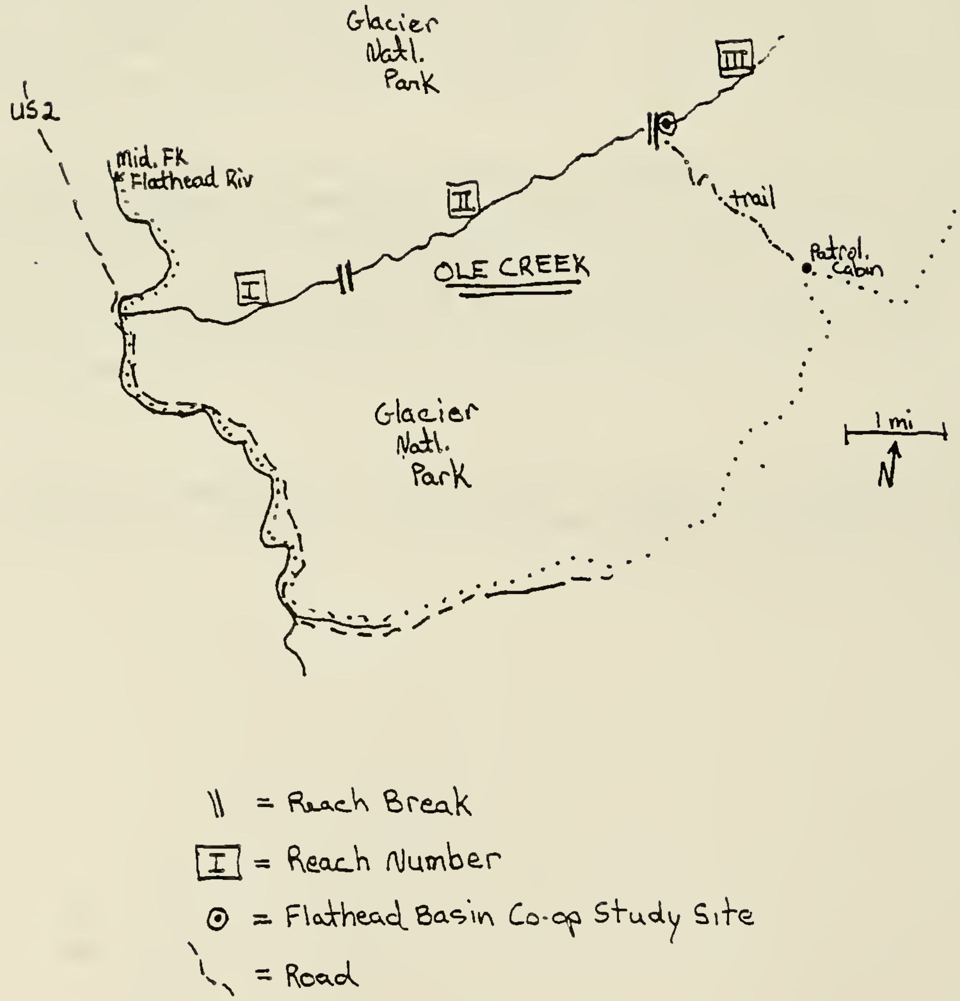
Reach I
The gradient increases (avg. 3%) relative to upstream reaches and the channel constricts into a bedrock canyon. The substrate consists primarily of large cobble and small boulders with the occasional large boulder. Bedload movement was evident, point bars were present and pools were filling with sand. Banks were generally stable. A delta of unstable material forms approximately 200 yards from the confluence with the river. Here the channel is incised to depths of 10 feet.

Reach II
Stream gradient is only 0.5 percent in this reach. The unstable channel meanders through a broad (200 - 300') floodplain that is sparsely vegetated by willow. Streambanks consisted of small cobble, gravel and, sand and were void of vegetation. Banks averaged 1 - 3' high and were eroding at bends. Oxbow cutoff ponds were evident at several locations. Channel scour and deposition were common in this reach.

Reach II has numerous avalanche chutes containing deeply incised ephemeral drainages. The gullies formed by these avalanches have exposed banks averaging 10' high through 30 to 40 percent of each drainage. It is more than likely that sediment form these drainages is transported to Ole Creek. Several areas of mass wasting up to 100' high by 300' long were observed adjacent to the stream channel. These areas show evidence of severe erosion and also contribute sediment to the channel. Most of this natural erosion is located sections 7 and 8.

Reach III
Gradient in this reach averages 2 percent and the channel character is similar to reach II. Occasional debris jams accelerate channel scour and bank erosion, but provide some habitat variation.

OLE CREEK


Glacier Natl. Park
US2
Mid. Fk Flathead Riv
I
II
III
OLE CREEK
trail
Patrol Cabin
Glacier Natl. Park
1 mi
N
= Reach Break
I = Reach Number
⊙ = Flathead Basin Co-op Study Site
= Road

STREAM NAME: PIPER CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.8SW., T.22 N., R.17 W. to Sec.18SW., T.22 N., R.17 W.. (Mouth at confluence with Swan River to road 966 x-ing Sec. 18)

RATING: 57% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest, roads
3. NPS Pollution	6/8	slash, litter, increased sediment
4. Bank Stability	10.5/12	
5. Substrate Composition	18/30	% of fines under C/R substrate fairly high but surface layer not cemented
6. Channel Stability	6/24	very unstable reach channel shift, scour, and deposition are common
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/3	
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	1/8	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	1/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	3/5	
- plants	2/2	

STREAM NAME: PIPER CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.18SE., T.22 N., R.17 W. to Sec.25SE., T.22 N., R.17 W.. (road #966 X-ing to just inside Sec. 25 near E. line)

RATING: 85% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest, recent and older
3. NPS Pollution	6/8	slash in stream, sed. from logging unit near observ. pt 4
4. Bank Stability	10/12	eros. at bends
5. Substrate Composition	18/20	
6. Channel Stability	12/16	chan. migration at large debris jams
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	debris may cause channel scour with high flows
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: PIPER CREEK
REACH NUMBER: III
REACH IDENTIFICATION: Sec.25SE., T.WW N., R.18 W. to Sec.25NW., T.22 N., R.18 W.. (just inside Sec. 25 near E. line to trail 119 x-ing NW Sec. 18)

RATING: 91% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	logging and road construction
3. NPS Pollution	6/8	slash and road sediment into Moore Cr.
4. Bank Stability	12/12	
5. Substrate Composition	18/20	minor pool filling
6. Channel Stability	15/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	1/8	slash in channel, litter (oil cans) on bank
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: PIPER CREEK
REACH NUMBER: IV
REACH IDENTIFICATION: Sec.25NW., T.22 N., R.18 W. to Sec.5NE., T.21 N., R.19 W.. (trail 119 x-ing to main fork in Sec. 5 NE)

RATING: 93% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	4/4	no activities in this reach other than back country use
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	26/30	minor sed. deposition in slackwater and pools
6. Channel Stability	14/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	minor channel erosion at one debris jam
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: **Piper Creek**

Piper Creek flows northeast from Piper Lake and the Crow Creek Pass Basin in the Mission Mountains Wilderness. It flows approximately ten miles to the confluence with the Swan River. Beginning at the mouth the stream is divided into four reaches (I - IV). Roading and logging occur in all reaches except IV. Specific conditions or problems observed by the surveyor are listed below.

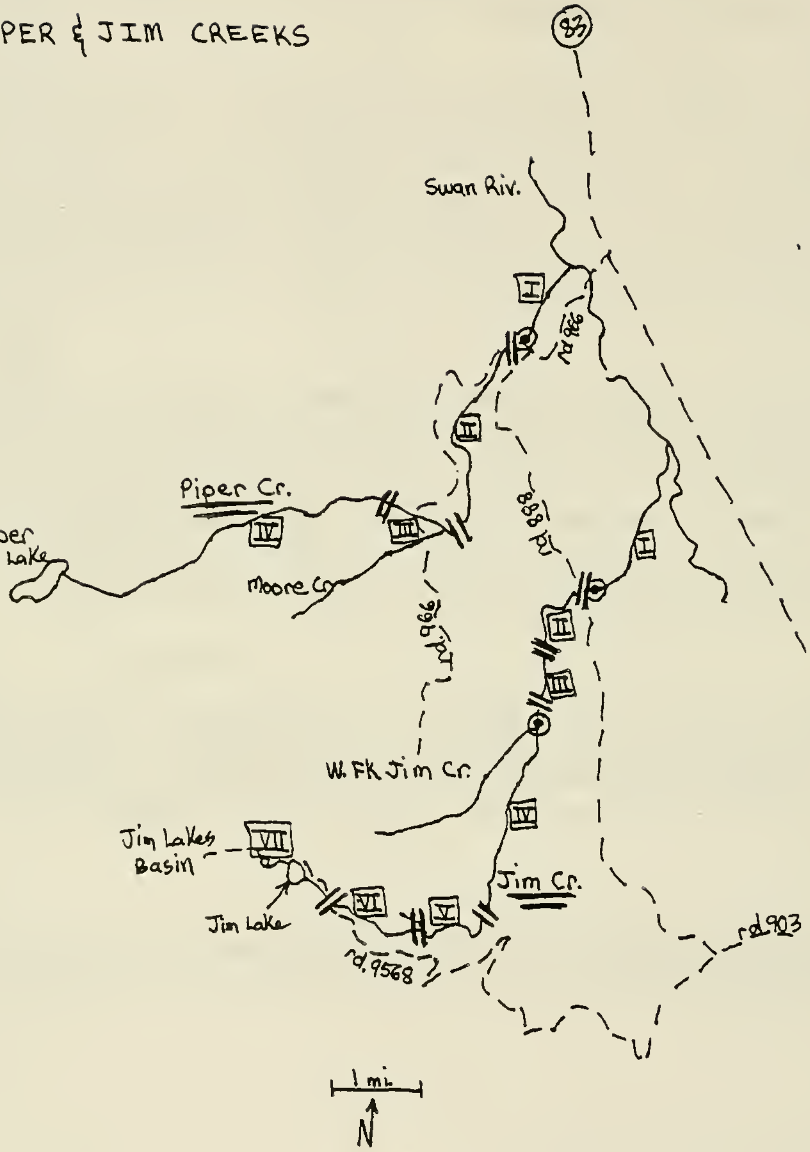
Reach I
The gradient in reach I is approximately 1 percent. This reach is characterized as an unstable, braided, depositional channel. Debris jams and beaver dams create a great deal of channel scour and migration. Point bars are common and pools are filling. Patchy cutting has occurred on the benches above the stream. Other than logging slash in the debris jams, no logging related problems were observed. In the northwest portion of section 18, woody debris has been placed along the bank to curb bank erosion.

Reach II
The gradient in this reach averages 4 percent. The upper section of the reach is characterized by a dense cedar forest that changes to a fir/shrub community in the lower third of the reach. This reach alternates between zones of deposition (especially in the cedar area) and scour. Debris jams are numerous, but most prevalent in the cedar area. The jams were observed to cause channel scour and migration. A large cutting unit in the southeast quarter of section 18 accumulates runoff onto steep slopes in the southeast corner. The slopes are eroding and contribute sediment to the stream.

Reach III
All of reach III lies in section 25. The gradient in this reach averages 8 percent. Substrate consists primarily of large cobble and boulders. New road construction in 1989 was observed to contribute sediment to Moore Creek and cause concern for potential sedimentation to Piper Creek. These problems have since be alleviated.

Reach IV
This is a high gradient (9%) reach with no management activity. Pools in this reach contained some sediment and one debris jam was causing channel migration and substantial scour.

PIPER & JIM CREEKS



\\ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

\ \ = Road

STREAM NAME: **RED MEADOW CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.8SE., T.35 N., R.21 W. to Sec.11NW., T.35 N., R.22 W.. (mouth at confluence with North Fork Flathead to road #115 crossing)

RATING: 75% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	3/4	Red Bench Fire damage
2. Land Use	3/4	timber harvest >10 years old, roads
3. NPS Pollution	8/8	sed. in chan. source unknown
4. Bank Stability	8/12	vert. eros. generally <1' high (one large bank >20' high)
5. Substrate Composition	6/10	riffles 1/3-2/3 embedded
6. Channel Stability	14/16	minor pool filling
7. (Streamside Veg.)	-	
- % bare ground	2/4	burned ground cover
- avg. width veg. zone	4/4	
- use or damage	1/4	
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	2/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	1/2	abundant filimentous algae possibly related to fire

STREAM NAME: **RED MEADOW CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.11NE., T.35 N., R.22 W. to Sec.23SW., T.35 N., R.23 W.. (road #115 crossing to road #115 crossing, Sec. 23)

RATING: 69% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	logging > 10 years old
3. NPS Pollution	4/8	slash, silt in road ditches
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	5/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	poor SMZ
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	1/4	debris jams cause substantial chan. migration
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	1/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **RED MEADOW CREEK**
REACH NUMBER: III
REACH IDENTIFICATION: Sec.23SW., T.35 N., R.23 W. to Sec.27SW., T.35 N., R.23 W.. (road #115 crossing, Sec. 23 to Sec. line SW Sec. 7)

RATING: 90% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest
3. NPS Pollution	6/8	slash in channel
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	15/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	poor SMZ, equip. operation near stream
- stream shading	4/4	variable
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash and litter
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1/3	
- plants	2/2	

Stream Name: **Red Meadow Creek**

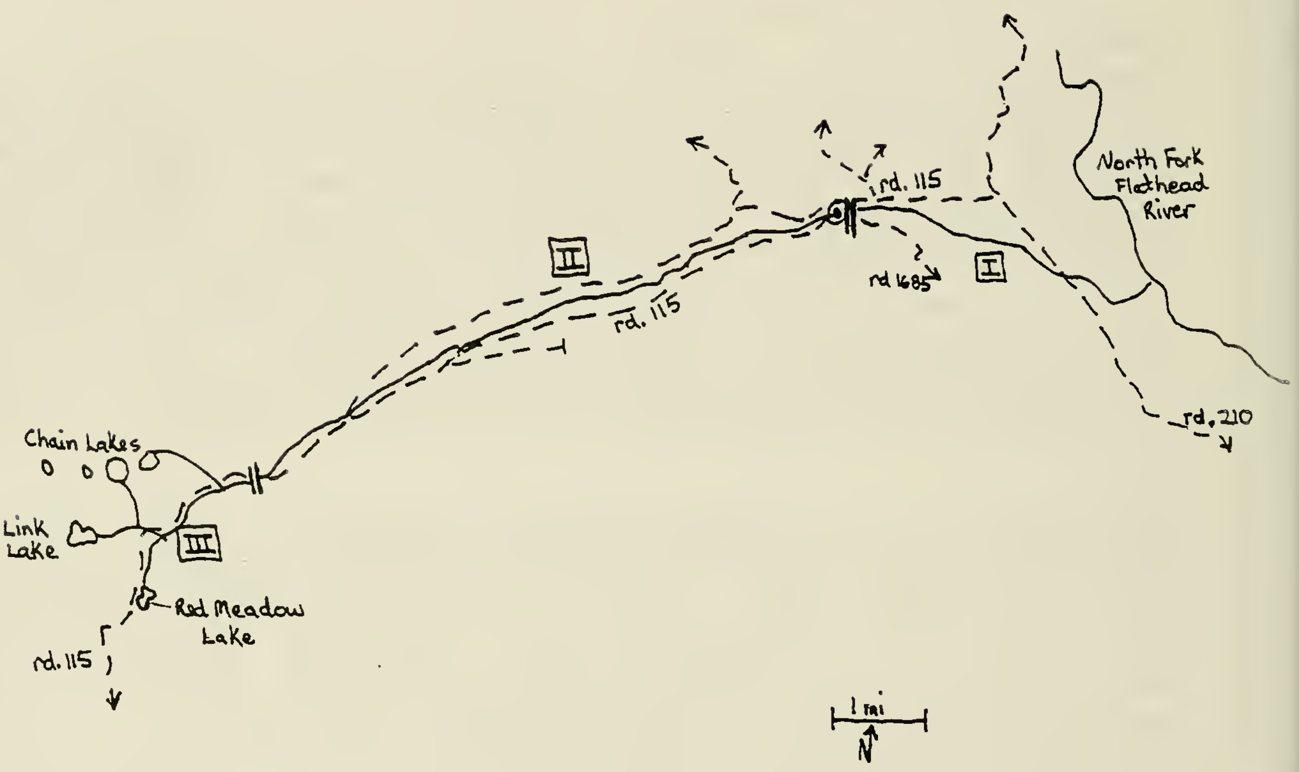
Red Meadow Creek basically begins at Red Meadow Lake on the east side of the Whitefish Range and flows in a northeast direction to its confluence with the North Fork of the Flathead River. Approximately 14 miles of this stream were assessed. This distance was broken into three reaches beginning at the mouth. Management activity in this drainage consists of primarily of logging and roading. The 1988 Red Bench Fire and related fire suppression activity are present in reach I and concentrated recreational activity occurs in reach III near Red Meadow Lake. Specific conditions or problems observed by the surveyor are listed below.

Reach I
Gradient in this reach averages 1 - 3 percent. Riffles were 1/3 - 2/3 embedded and channel stability good. Debris jams were uncommon. Wildfire occurred throughout the reach however, patches of unburned timber and streamside vegetation occur randomly as do areas where the streamside vegetation is gone. Inadequate erosion control was apparent on fire roads in sections 7 and 12. Blowdown though not extreme, was present and contributing to bank instability. No soil or ash erosion was observed however, conditions were such that future erosion and sedimentation to the stream is likely. Stream shading has been greatly reduced and green filamentous algae was abundant. A naturally eroding bank approximately 25' high by 100' long was observed in section 7. This bank is adjacent to the stream and likely contributes sediment to the stream. Streambanks one foot high, downstream of this area are vertical and eroding.

Reach II
The gradient here averages about 2 percent. Debris jams are common in this reach and composed of approximately 50 percent logging slash. Jams are causing bank erosion and channel scour. Pools are filling with sediment. Timber harvest units parallel most of the upper portion of the reach. Streamside management zones (SMZs) vary in width however, some are non-existent. Blowdown has occurred in the narrower SMZs causing bank erosion and sedimentation to the stream. Avalanches in section 13 have damaged the SMZ in several locations. Cutting has occurred on steep slopes of an unnamed tributary in section 19 near the beginning of road 1662. This stream exhibits channel scour and bank erosion and likely contributes sediment to Red Meadow Creek. Cutbank seeps associated with logging units along road 115 (NW 1/4 of sec. 16) appear to be increasing sediment into road ditches. Some of these ditches drain into ephemeral drainages.

Reach III
Gradient averages 6 percent in this reach. The banks are generally well vegetated and stable. The substrate consists of small boulders and cobble, embeddedness is less than 1/3. A road cut on road 115 is eroding and contributing sediment to Chain Lakes Creek. Road ditch erosion on rd. 115 above Red Meadow Lake contributes sediment to the marsh above the lake. Timber harvest has occurred from the Link Lake tributary through the Chain Lakes tributary. Most of this cutting is over ten years old however, areas of narrow or non-existent SMZs are common as was equipment operation in close proximity to the channels. Stream shading is greatly reduced in these areas however, excessive sedimentation was not observed.

RED MEADOW CREEK



‖ = Reach Break

$\boxed{\text{I}}$ = Reach Number

⊙ = Flathead Basin Co-op Study Site

⋱ = Road

STREAM NAME: SHEPPARD CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.8SE., T.30 N., R.24 W. to Sec.12NE., T.30 N., R.25 W.. (mouth at Griffin Creek to road #2921 crossing)

RATING: 58% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	grazing, logging >200'
3. NPS Pollution	4/8	trampled banks - sed., litter
4. Bank Stability	7/12	bank trampling by livestock
5. Substrate Composition	14/30	only one riffle observed, generally low gradient silty bottom
6. Channel Stability	10/16	deposition dominates
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	2/4	< 25'
- use or damage	2/4	livestock damage
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	few present
9. Turbidity	3/8	recent rain
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	1/8	manure on banks, litter in stream
14. Water Odor	3/4	natural odor
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	-1/2	

STREAM NAME: SHEPPARD CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.11NE., T.30 N., R.25 W. to Sec.18NE., T.30 N., R.25 W.. (road 2921 crossing to road 5388 crossing)

RATING: 78% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

PARAMETER	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	recent logging
3. NPS Pollution	6/8	slash, litter, excessive sediment
4. Bank Stability	12/12	
5. Substrate Composition	19/30	substrate cemented, riffles <1/3, runs 1/3 embedded, pools 20-30% full
6. Channel Stability	13/16	pool filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	3/8	recent rain
10. Water Surface Oil	3/4	slight sheen, natural
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	1/8	slash and litter
14. Water Odor	3/4	natural odor
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	1.5/8	
- plants	-1/2	

STREAM NAME: **SHEPPARD CREEK**
REACH NUMBER: **III**
REACH IDENTIFICATION: Sec.18NE., T.30 N., R.25 W. to Sec.23NE., T.30 N., R.26 W.. (road 5388 crossing to road 2973 crossing)

RATING: 93% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest
3. NPS Pollution	6/8	slash, litter, road sediment
4. Bank Stability	12/12	
5. Substrate Composition	30/30	
6. Channel Stability	14/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	3/8	off color, suspected beaver activity
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash, litter
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	2/3	
- plants	-1/2	

STREAM NAME: **SHEPPARD CREEK**
REACH NUMBER: **IV**
REACH IDENTIFICATION: Sec.23NE., T.30 N., R.26 W. to Sec.21SE., T.30 N., R.26W. (road 2973 x-ing to end of road, NE. sec. 27)

RATING: 77% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest
3. NPS Pollution	4/8	excessive sed., slash, litter, nuisance algae
4. Bank Stability	12/12	
5. Substrate Composition	17/30	riffles & runs = 1/3-2/3 embedded, pools filling
6. Channel Stability	13/16	pool filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	1/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish		
- plants	-1/2	

Stream Name: Sheppard Creek

Sheppard Creek drains east from the Brush Creek Divide, approximately 16.8 miles to its confluence with Griffin Creek in the Star Meadows area of the Tally Lake Ranger District (Flathead National Forest). Beginning at the mouth, Sheppard Creek is divided into four reaches (I - IV). The stream gradient averages 7 percent in reach IV, 2 percent in reaches II and III, and less than 1 percent in reach I. Management activity in this drainage consists primarily of grazing, logging and road building. Specific conditions or problems observed by the surveyor are listed below.

Reach I
The low gradient, incised channel meanders through a meadow area with relatively deep, turbid water throughout. The substrate consists mainly of fine material. Riffles are uncommon. Aquatic macrophytes and algae were common to abundant, indicating potential nutrient enrichment. Increased sunlight and water temperature, due to light canopy cover may also have influenced algal growth.

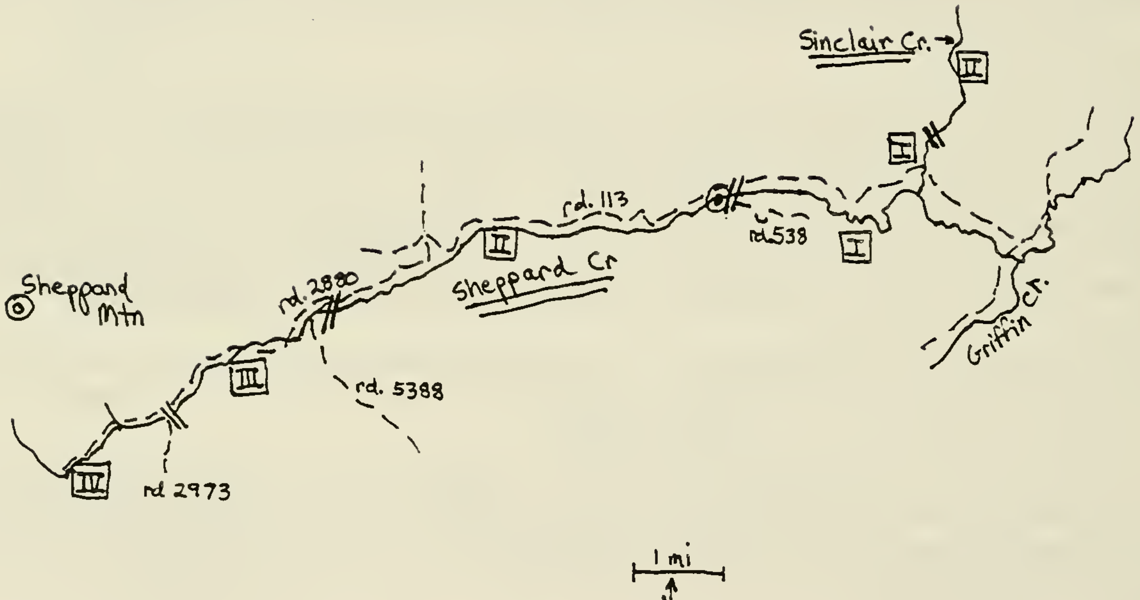
Stream banks were steep but generally stable and well vegetated by willow. Bank damage due to cattle was observed at several locations.

Reach II and III
Substrate is primarily large and small cobble with boulders present in the higher gradient areas. A waterfall occurs in Reach II (section 8 below Dunshire Creek). Beaver dams were scattered throughout both reaches. Excessive algal growth was observed in several of the beaver ponds. Debris jams occur throughout, no related stability problems were observed. Stream banks were stable and well vegetated except in several areas that were logged and had poor streamside management zones (SMZs). Numerous logging units occur in these reaches.

Problems associated with logging or roads were observed at several locations.
* Sediment from a cutting unit in the NW 1/4 of section 17 has the potential to reach the stream due to an inadequate SMZ.
* A tributary entering the upstream end of Reach III (section 24) has several large cutting units with inadequate SMZs. Stream shade has been eliminated for up to 1/2 mile. Debris jams consisting of logging slash have dammed the channel causing braiding and bank erosion. Machinery has crossed the channel in several locations. Stream sedimentation from road erosion was observed near the junction of roads 2973 and 2885.

Reach IV
Stream banks are stable and well vegetated by shrubs, fir and spruce. The substrate consists primarily of large and small cobble. Embeddedness is fairly high (1/3 - 2/3) however, no clear sediment source was observed. Debris jams are numerous and contain some older logging slash. Debris jams were not causing channel instability. Older (>10 yrs) selective and clearcut timber harvest has occurred in this reach with no related problems observed.

SHEPPARD & SINCLAIR CREEKS



‖ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

╲ = Road

STREAM NAME: SINCLAIR CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.7NE., T.30 N., R.24 W. to Sec.6SE., T.30 N., R.24 W.. (mouth at confluence with Sheppard Creek to upstream end of pvt. Sec.6 SE 1/4-1/4)

RATING: 35% = severe impairment, (non-support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest, grazing, machinery in stream
3. NPS Pollution	4/8	manure, litter, excessive sed., algal blooms
4. Bank Stability	4/12	livestock trampling
5. Substrate Composition	5/30	low gradient depositonal reach
6. Channel Stability	10/24	
7. (Streamside Veg.)	-	
- % bare ground	2/4	trampling
- avg. width veg. zone	1/4	width <25'
- use or damage	1/4	logging, grazing, blow down
- stream shading	1/4	< 25% shaded
- sed. filtering capacity	1/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	0/8	slash, manure, litter
14. Water Odor	3/4	natural
15. Dewatering	0/8	severely dewatered probably related to grazing damage
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	-1/2	

STREAM NAME: SINCLAIR CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.6SE., T.30 N., R.24 W. to Sec.32NW., T.31 N., R.24 W.. (upstream end of pvt. 1/4 Sec. 6 to headwaters at road #9502)

RATING: 48% = severe impairment, (non-support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	grazing, timber harvest
3. NPS Pollution	4/8	manure, sed. from trampled banks
4. Bank Stability	7/12	banks trampled
5. Substrate Composition	5/30	sediment dominated substrate no habitat
6. Channel Stability	10/24	heavy deposition, braiding from trampling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	grazing, logging
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	N/R	None present
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	0/8	manure all over
14. Water Odor	4/4	
15. Dewatering	0/8	severely dewatered related to grazing and logging?
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	-1/2	abundant plant growth

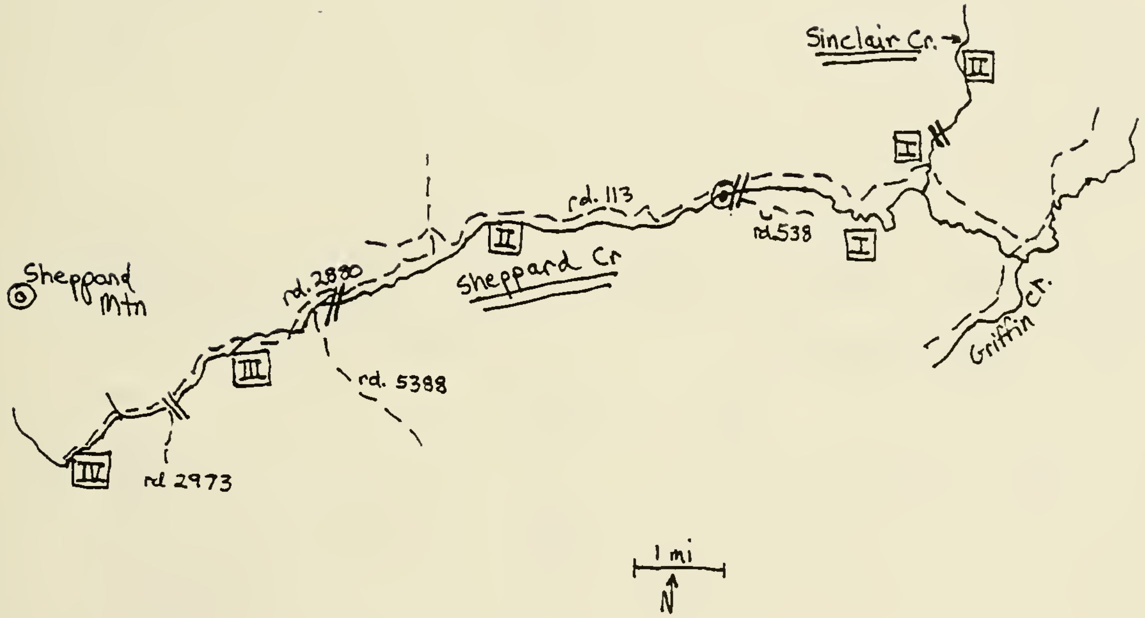
Stream Name: Sinclair Creek

Sinclair Creek is 2.3 miles in length and an intermittent second order tributary to Sheppard Creek. Sheppard Creek is divided into two reaches (I and II) based primarily on gradient and land use.

Reach I
Average gradient is less than 1 percent. This reach has extensive logging and grazing activity that has resulted in severe stream impairment. Specific problems include an inadequate streamside management zone resulting in blowdown and potentially elevated stream temperatures due to excessive canopy openings. Equipment operation across the stream and bank trampling by cattle have caused severe channel degradation and sedimentation. Excessive algal growth and sediment deposition was observed in the downstream portion of this reach.

Reach II
Gradient averages greater that 3 percent. Flow was intermittent at the time of assessment. Logging and grazing are also common in this reach. Bank trampling and sloughing due to cattle are the primary problem although, logging on the upstream end of the reach has severely reduced stream canopy cover.

SHEPPARD & SINCLAIR CREEKS



\\ = Reach Break

[I] = Reach Number

⊙ = Flathead Basin Co-op Study Site

⸌ = Road

STREAM NAME: SQUEEZER CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.17SW., T.23 N., R.17 W. to Sec.27SE., T.23 N., R.17 W.. (mouth at confluence with Goat Creek to road x-ing SE corner Sec. 27)

RATING: 77% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest, mostly older
3. NPS Pollution	6/8	slash, sediment in stream?
4. Bank Stability	12/12	
5. Substrate Composition	19/30	riffles = 1/3, runs = 1/3-2/3 embedded, pools 30-40% fines
6. Channel Stability	11/16	scour present, point bars evident
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3.5/4	
- stream shading	3/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: SQUEEZER CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.27SE., T.23 N., R.17 W. to Sec.26SW., T.23 N., R.17 W.. (road x-ing SE corner Sec. 27 to 0.4 mile upstream, Sec. 26 SW)

RATING: 87% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	loging > 10 years old
3. NPS Pollution	6/8	slash in stream
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	19/24	minor, pool filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	2.5/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash, litter (outfitters camp)
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	fish barrier between obs. pts. 1 & 2
- plants	2/2	

STREAM NAME: SQUEEZER CREEK
REACH NUMBER: III
REACH IDENTIFICATION: Sec.26SW., T.23 N., R.17 W. to Sec.32NE., T.23 N., R.16 W.. (approximately 3 miles upstream of Sec. 26 SW corner to major forks near end of trails Sec. 32)

RATING: 95% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	4/4	
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	13/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

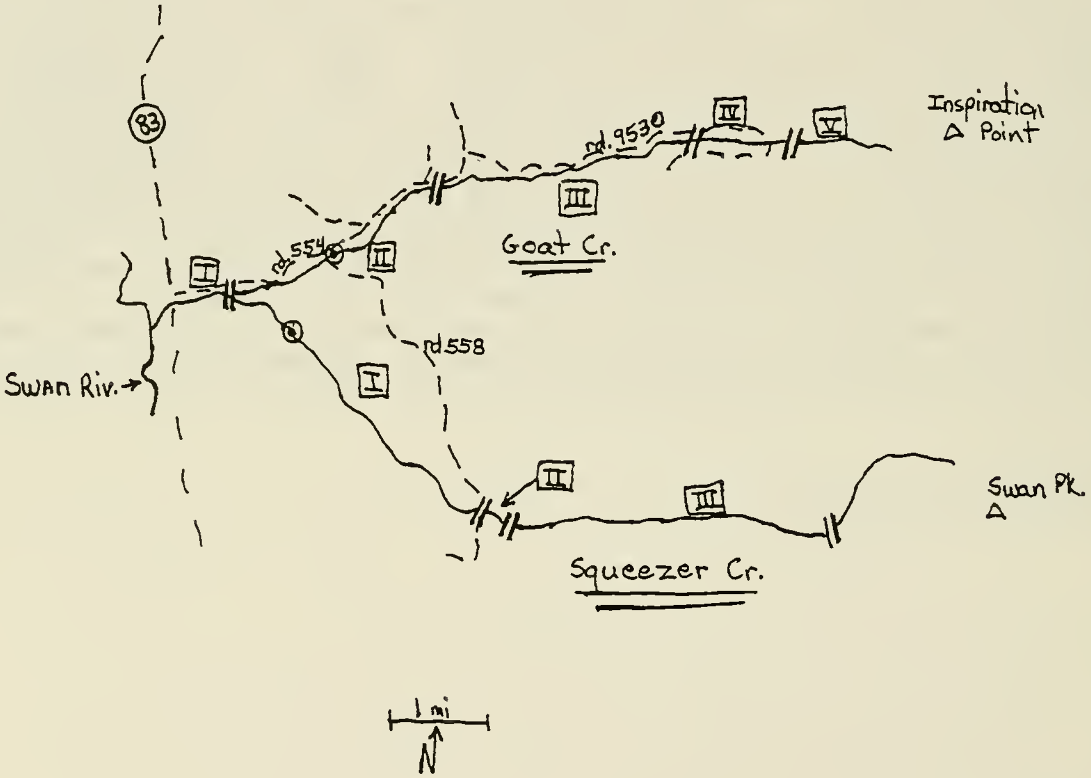
Stream Name: **Squeezer Creek**

Squeezer Creek flows west from the northwest side of Swan Peak for approximately 9 miles to its confluence with the Goat Creek. Beginning at the mouth the stream has been divided into three reaches (I - III). Management activities, primarily logging and some roading, occur in reach I and II only. Specific conditions or problems observed by the surveyor are listed below.

Reach I and II
The gradient averages 1 - 3 percent in these reaches. The stream character changes from a low gradient (<1%), meandering, broad valley bottom near the mouth to a higher gradient, straight, large substrate channel in upstream areas. Starting from the mouth, riparian vegetation shifts from a partially open fir/shrub complex to a cedar dominated, closed canopy in the upstream areas. Debris jams containg a substantial amount of logging slash are common in both reaches, but less abundant near the mouth. Debris jams were observed to be causing bank cutting, channel migration, and channel scour. These conditions were more prevalent in the upper two thirds of the reach. Several steep cascades are present in reach II. Timber harvest occurs throughout both reaches. Several springs, located in a logging unit near the 9758 road crossing were not afforded buffer zones. These springs drain to the road ditch which flows into Squeezer Creek. No sedimentation problems were observed at this site. Channel migration and braiding associated with older timber harvest was observed in the southwest quarter of section 27. Cut tree stumps were observed in the channel and on the stream banks. Debris jams appeared to cause the channel migration. A great deal of recent deposition (gravel and sand) has also occurred in this area.

Reach III
Narrative unavailable.

GOAT & SQUEEZER CREEKS



|| = Reach Break

$\boxed{\text{I}}$ = Reach Number

⊙ = Flathead Basin Co-op Study Site

\ = Road

STREAM NAME: **SULLIVAN CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.1NE., T.26 N., R.16 W. to Sec.11SE., T.26 N., R.17 W.. (mouth at Hungry Hourse Reservoir to Quintonkon Creek)

RATING: 64% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest (> 10 years old) near mouth
3. NPS Pollution	6/8	bridge material in stream
4. Bank Stability	4/12	large areas of bank slump some up to 50' high X 75' long
5. Substrate Composition	13/20	
6. Channel Stability	7/16	scour at debris jams
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	liter from bridge construction
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **SULLIVAN CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.11SE., T.26 N., R.17 W. to Sec.24SW., T.26 N., R.17 W.. (Quintonkon Creek to SW Sec. 24 just N. of Sec. line, near road)

RATING: 67% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest
3. NPS Pollution	7/8	minor amounts of slash in streams
4. Bank Stability	5/12	large slumps to a tp' high X 50-75' long
5. Substrate Composition	13/20	riffles approaching 1/3 embedded, runs 1/2-2/3
6. Channel Stability	7/16	bedload movement and channel migration common
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	scour at debris jams
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	minor amounts of slash in stream
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: SULLIVAN CREEK
REACH NUMBER: III
REACH IDENTIFICATION: Sec.24SW., T.26 N., R.17 W. to Sec.31NE., T. N.26N,R.16 W.. (SW. Sec.24 just N. of Sec. line to confluence of Connor Cr.)

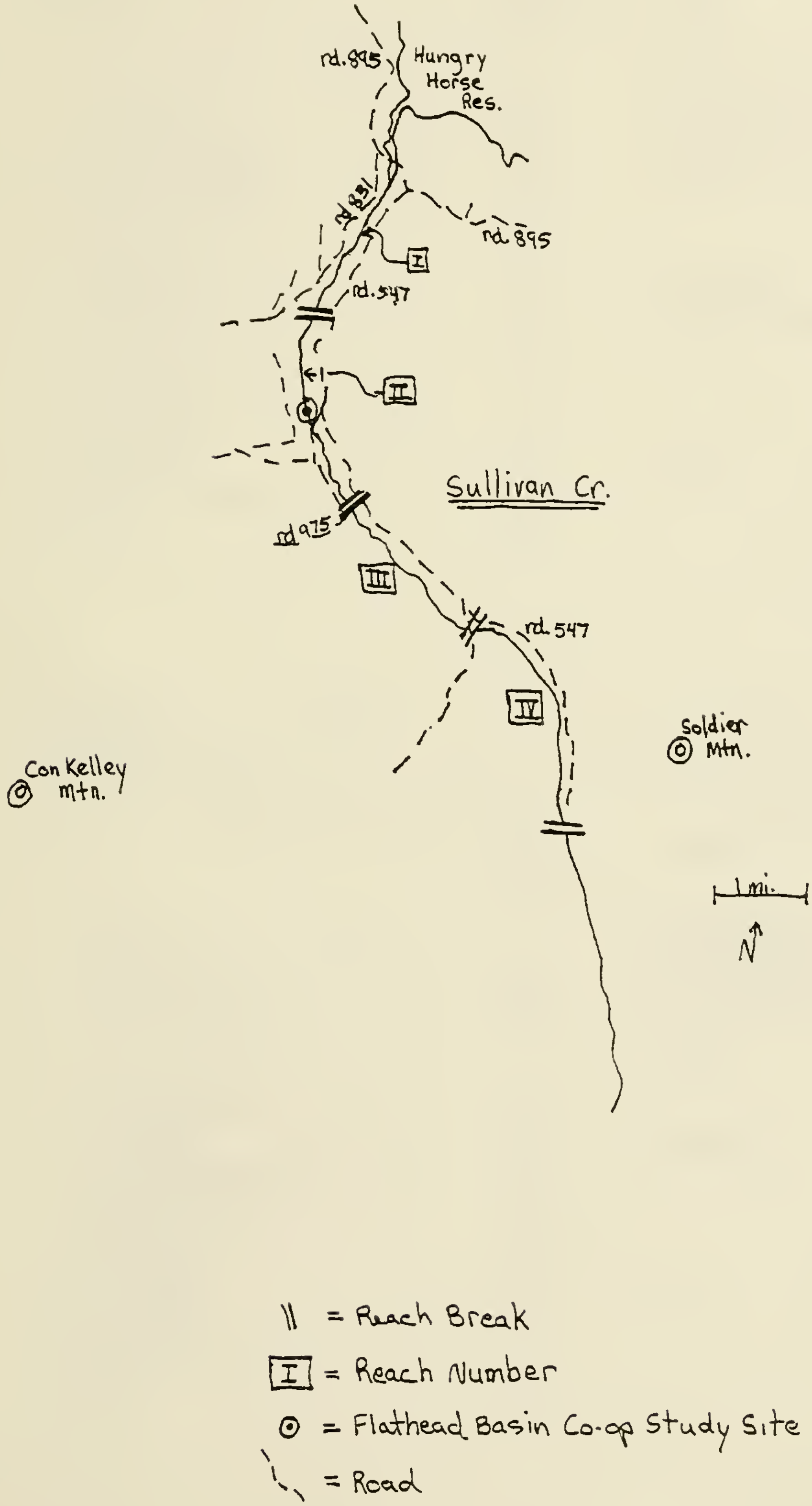
RATING: 93% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	3/4	timber harvest, roads
3. NPS Pollution	6/8	road material graded into road ditch
4. Bank Stability	11/12	
5. Substrate Composition	20/20	
6. Channel Stability	15/16	minor point bar devpt
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	4/4	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	6/8	minimal amount slash, sediment in road ditch
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: SULLIVAN CREEK
REACH NUMBER: IV
REACH IDENTIFICATION: Sec.31NE., T.26 N., R.16 W. to Sec.8NW., T.25 N., R.16 W.. (confluence Connor Creek to confluence with Slide Creek)

RATING: 99% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	3/4	road, timber harvest in Slide Cr. drainage
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	20/20	
6. Channel Stability	8/8	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)		
- fish	N/R	
- plants	2/2	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= Flathead Basin Co-op Study Site
= Road

STREAM NAME: SWIFT CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.5 mid., T.31 N., R.22 W. to Sec.14SW., T.33 N., R.23 W.. (inlet, Whitefish Lake to confluenced with Antice Creek)

RATING: 66% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	2/4	eroding banks adjacent to stream
2. Land Use	1/4	grazing, hay field
3. NPS Pollution	6/8	slash, in stream sediment?
4. Bank Stability	8/12	
5. Substrate Composition	6/10	riffles avg 1/3-2/3 embedded
6. Channel Stability	13/24	scour and pt. bars common, frequent braids
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	2/4	instability in debris jams, scour below jams
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	0/8	slash, litter
14. Water Odor	4/4	
15. Dewatering	6/8	natural
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: SWIFT CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.14SW., T.33 N., R.23 W. to Sec.3NW., T.33 N., R.23 W.. (confluence Antice Creek to confluence of E. and W. Forks)

RATING: 65% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	3/4	eroding banks adjacent to stream
2. Land Use	1/4	timber harvest, roads
3. NPS Pollution	6/8	slash, in stream sed.?
4. Bank Stability	9/12	10-20% slumping and vert. eroding banks avg size >3' x >20'
5. Substrate Composition	16/30	riffles = 1/3-2/3 runs 2/3 embedded, habitat impaired
6. Channel Stability	11/24	scour and point bar common, pools filled, overflow channel braiding
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	some blow down
- stream shading	3/4	51-75% shading
- sed. filtering capacity	3/3	
8. Channel Modifiers	3.5/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: EAST FORK SWIFT CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.3NW., T.33 N., R.23 W. to Sec.28NW., T.34 N., R.23 W.. (confluence E & W Forks to Upper Whitefish Lake outlet)

RATING: 80% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest
3. NPS Pollution	6/8	slash, litter
4. Bank Stability	11/12	
5. Substrate Composition	13/20	riffles = 1/3, runs 2/3 embedded lake traps some sediment
6. Channel Stability	19/24	some scour and point bar formation, minor? pool filling
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash, litter mostly at lake outlet
14. Water Odor	4/4	
15. Dewatering	6/8	subsurface flow
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: EAST FORK SWIFT CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.28NW., T.34 N., R.23 W. to Sec.4SW., T.34 N., R.23 W.. (Upper Whitefish Lake inlet to just N. of Sec. 4SW line)

RATING: 50% = severe impairment, (non-support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	3/4	areas of eroding banks adjacent to stream
2. Land Use	1/4	timber harvest
3. NPS Pollution	5/8	slash, in stream sed.?
4. Bank Stability	1/12	debris jams (50% slash) flow deflection/chan migration leads to bank eros.
5. Substrate Composition	12/20	riffles 1/3-2/3, runs 2/3 embedded habitat impaired
6. Channel Stability	8/24	severe scour, pools filling, large pt, bars
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	2/4	blow down due to poor SMZ and chan migration
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	1/4	see comments for bank erosion
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	0/8	slash, minor litter
14. Water Odor	4/4	
15. Dewatering	2/8	subsurface, logging may influence
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: EAST FORK SWIFT CREEK
REACH NUMBER: I11
REACH IDENTIFICATION: Sec.4SW., T.34 N., R.23 W. to Sec.32NE., T.35 N., R.23 W.. (just N. of Sec. 4 line to headwaters trail #372)

RATING: 68% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	RATING #/total	COMMENTS
1. Natural Erosion	3/4	eroding bank adjacent to stream
2. Land Use	1/4	timber harvest
3. NPS Pollution	6/8	slash, trash, road sediment
4. Bank Stability	10/12	upper end of reach
5. Substrate Composition	13/20	riffles 1/3-2/3, runs 2/3 habitat impaired
6. Channel Stability	12/24	braids at larger jams
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	blow down, logging poor SMZ
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	2.S/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	dewatered in upper reach
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: **East Fork Swift Creek**

The East Fork of Swift Creek (Swift Creek) flows south approximately 8.8 miles from the west side of Link Mountain to its confluence with the West Fork. Beginning at the confluence, this stream is divided into three reaches (I - III). Swift Creek flows through Upper Whitefish lake at the break between reach I and II. Timber harvest and roading are the only management activities in this drainage. Specific conditions and problems observed by the surveyor are listed below.

Reach I

Reach I begins at the outlet of Upper Whitefish Lake, and has an average gradient of 2 percent. An abundance of filamentous algae is present in the stream below the lake outlet. This reach exhibits relatively minor areas of channel scour, point bar deposition and bank erosion as compared to the other two reaches. Timber harvest has occurred in section 3 near the confluence with the West Fork. Best management practices were applied here and no related stream impacts observed.

Reach II

Gradient averages just over 1 percent, flow is intermittent below mid section 17. Similar to reach III in that there are areas of deep channel incision as well as bank erosion and point bar development. Older (>10yrs.) timber harvest occurs throughout this reach. Although most of the streamside management zones (SMZs) were wider than 50', a prevalence of blowdown suggests that the SMZ should have been wider or designed differently. The blowdown has caused excessive debris accumulation in the channel and sedimentation from root wads and bank disruption. Debris jams in this reach are causing channel scour and bank erosion. Stream channel instability (braiding) as indicated by mid channel standing trees was present within cutting units in section 17.

Reach III

Gradient in this reach averages 9 percent. The upper end of this reach has a deeply incised channel (5 - 10'). The unvegetated stream banks are eroding and likely contribute sediment to the stream. Point bars are common and pools are filling with sand. Debris jams though uncommon contribute to bank erosion and channel scour in this reach. Frequency of debris jams increase toward the lower end of this reach. A minor amount of older logging occurs in section 33 but does not appear to be a problem. In section 33, Road 589 has washed out in several locations and probably contributes sediment to the stream.

STREAM NAME: **WEST FORK SWIFT CREEK**
REACH NUMBER: I
REACH IDENTIFICATION: Sec.3NW., T.33 N., R.23 W. to Sec.29NW., T.34 N., R.24 W.. (confluence E & W Forks to upper road X-ing Sec. 29)

RATING: 69% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	old timber harvest
3. NPS Pollution	6/8	slash, in stream sed.?
4. Bank Stability	9/12	-10% eroding
5. Substrate Composition	10/20	riffles runs avg. 2/3 embedded
6. Channel Stability	7/16	scour and pt. bars
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **WEST FORK SWIFT CREEK**
REACH NUMBER: II
REACH IDENTIFICATION: Sec.29NW., T.34 N., R.24 W. to Sec.12SE., T.34 N., R.24 W.. (upper road x-ing Sec. 29NW to lower road x-ing Sec. 12)

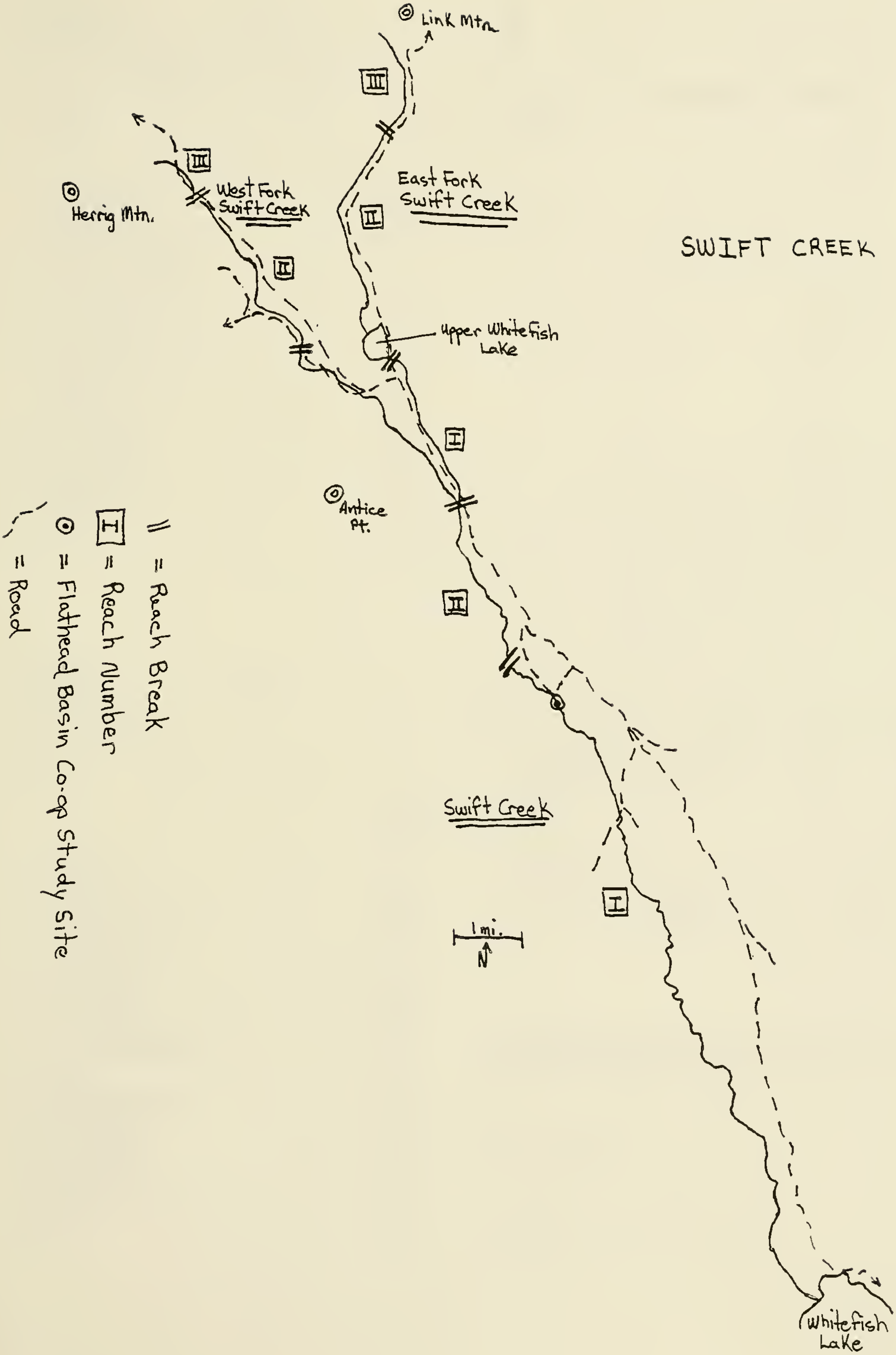
RATING: 65% = moderate impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest >10 years old
3. NPS Pollution	6/8	slash, sed?
4. Bank Stability	10.5/12	
5. Substrate Composition	5/20	riffles avg 2/3 runs >2/3 embedded - habitat impaired -
6. Channel Stability	8/16	scour @ constrictions and drops, point bars
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	minor amounts of slash in stream
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **WEST FORK SWIFT CREEK**
REACH NUMBER: III
REACH IDENTIFICATION: Sec.12SE., T.34 N., R.24 W. to Sec.11NE., T.34 N., R.24 W.. (lower road x-ing Sec. 12 to confluence of first orders Sec. 12, below lakes)

RATING: 54% = severe impairment, (non-support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest, roads
3. NPS Pollution	6/8	slash, some litter
4. Bank Stability	2/12	>40% eroding banks with avg size >3' x 20' severe erosion
5. Substrate Composition	N/R	not rated dry channel, but silty bottom
6. Channel Stability	5/16	chan blown out water yield effected by logging? shifting substrate - extensive scour -
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	logging damage
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	2/4	
9. Turbidity	N/R	Dry
10. Water Surface Oil	N/R	Dry
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash and litter
14. Water Odor	N/R	
15. Dewatering	2/8	ephemeral
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	N/R	


SWIFT CREEK

Link Mtn.
III
III
East Fork Swift Creek
West Fork Swift Creek
Herrig Mtn.
II
II
Upper Whitefish Lake
I
Antice Pt.
II
Swift Creek
I
1 mi.
N
Whitefish Lake
// = Reach Break
I = Reach Number
⊙ = Flathead Basin Co-op Study Site
- - = Road

STREAM NAME: TIGER CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.23NW., T.30 N., R.18 W. to Sec.12SE., T.30 N., R.18 W.. (mouth at confluence with Hungry Horse Creek to confluence with Turmoil Creek)

RATING: 94% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	18/20	riffles <1/3, runs average 1/3 embedded
6. Channel Stability	15/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: TIGER CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.12SE., T.30 N., R.18 W. to Sec.36SE., T.31 N., R.18 W.. (confluence with Turmoil Creek to Sec. 36 line)

RATING: 94% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	timber harvest
3. NPS Pollution	8/8	
4. Bank Stability	11/12	minor problems at collapsed bridge
5. Substrate Composition	10/10	
6. Channel Stability	8/8	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3/4	collapsed bridge near Turmoil Creek causes some chan. migration and is a potential fish barrier
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	collapsed bridge
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	potential barrier near Turmoil Creek
- plants	2/2	

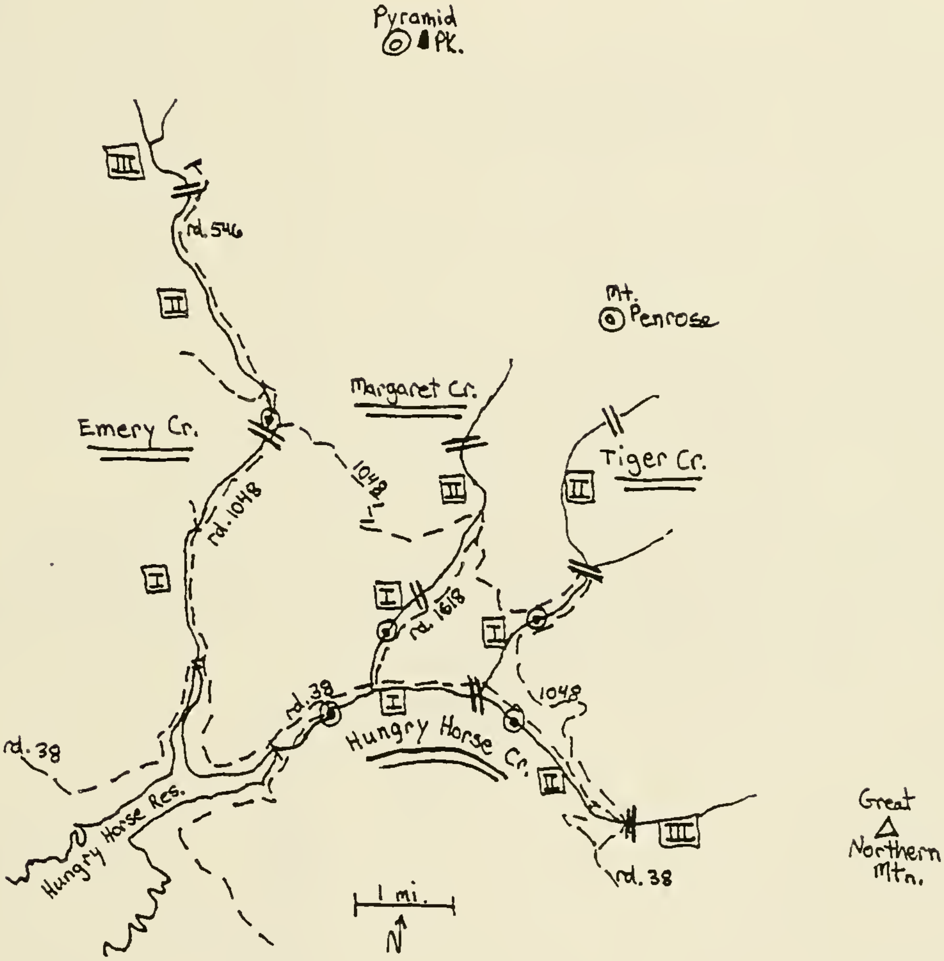
Stream Name: **Tiger Creek**

Tiger Creek is a second order drainage that flows southwest from the west side of Nyack Mountain to the confluence of Hungry Horse Creek. The stream is divided into two reaches (I & II) totaling approximately four miles in length. Management activity consists of logging and roading and occurs in reach I and the lower half of reach II. Specific conditions and problems observed by the surveyor are listed below.

Reach I
Gradient averages just over 3 percent. Substrate is primarily cobbles and coarse gravels. Small areas of bank erosion were observed at bends just above the confluence with Hungry Horse Creek. A substantial portion of the east side of this reach has been logged. In all areas observed, best management practices were applied and effective.

Reach II
Gradient in this reach is steep ranging from 3 percent in the downstream areas to 13 percent in the upper reach. The substrate is a mixture of boulders, cobble and coarse gravels. Banks are stable and well vegetated. Selective timber harvest occurs in a small area just above road 1048. A collapsed bridge near the confluence of Turmoil Creek creates a debris jam that deflects current and has caused bank erosion.

EMERY, MARGARET, TIGER, HUNGRY HORSE CREEKS



‖ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

- - = Road

STREAM NAME: **TRAIL CREEK**
REACH NUMBER: **I**
REACH IDENTIFICATION: Sec.36SE., T.37 N., R.22 W. to Sec.30NW., T.37 N., R.22 W.. (mouth at confluence with N. Fk Flathead River to canyon area SE 1/4 of NW 1/4 Sec.30.

RATING: 91% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	3/4	timber harvest
3. NPS Pollution	8/8	none observed in this reach
4. Bank Stability	11/12	
5. Substrate Composition	10/10	
6. Channel Stability	6/8	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	2/4	25-50% shaded, broad flood plain
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **TRAIL CREEK**
REACH NUMBER: **II**
REACH IDENTIFICATION: Sec.30NW., T.37 N., R.22 W. to Sec.36NW., T.37 N., R.22 W.. (canyon area SE 1/4 of NW 1/4 Sec.30 to confluence of Thoma and Yakinikak creeks)

RATING: 94% = non-impaired, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	2/4	Road
3. NPS Pollution	8/8	
4. Bank Stability	12/12	
5. Substrate Composition	10/10	
6. Channel Stability	12/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	2/8	natural, subsurface flow
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

Stream Name: Trail Creek

Trail Creek flows begins at the confluence of Thoma Creek and Yakinikak Creeks and flows easterly 7.5 miles to the confluence with North Fork of the Flathead River. Beginning at the mouth the stream is divided into two reaches. Stream gradient averages 1.5 percent throughout. Management activity consists primarily of roading and to a lesser extent timber harvest and residential development. Specific management activities and problems observed by the surveyor are listed below.

Reach I

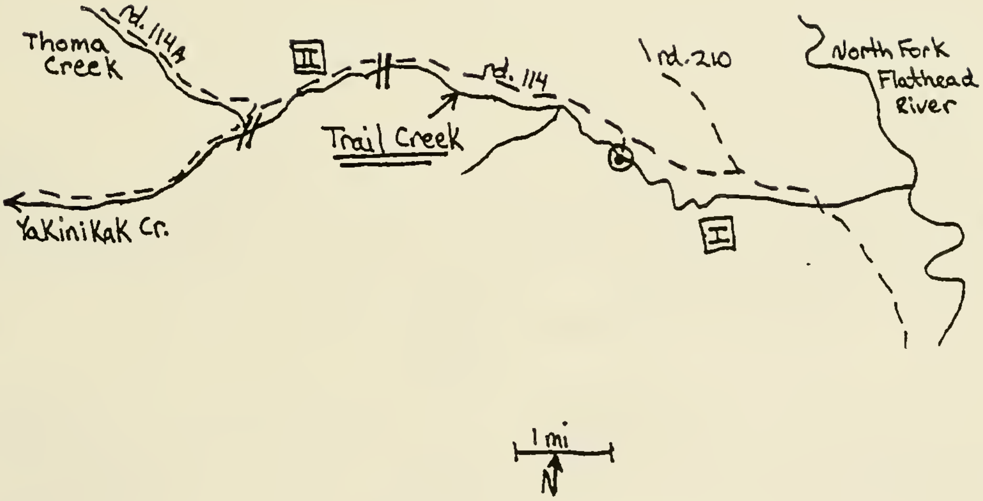
The stream meanders through a broad glacial floodplain, downcutting is minimal. The substrate consists of unembedded cobble and gravel and generally forms a continuous riffle throughout the reach. Woody debris is uncommon as are pools. Some bank erosion occurs on bends and at debris jams. A large naturally eroding bank is located in mid section 30. This bank is directly adjacent to the stream and source of stream sediment. Timber harvest occurs greater than 200' from the channel and causes no stream problems. Road BMPs are effective.

Reach II

The stream flows subsurface (during summer) for the upper 0.5 miles of this reach. The stream is confined to a canyon with substrate consisting of large cobble, small boulders and occasional large boulders. Woody debris is essentially absent in this reach.

A large eroding bank in section 28 near the Thoma Creek road junction contributes sediment to the stream. Road 114 crosses this bank and frequently washes out. This area is frequently repaired by recutting the road grade across the unstable slope. Each time the road is repaired sediment is sidecast into the stream.

TRAIL CREEK



∥ = Reach Break

I = Reach Number

⊙ = Flathead Basin Co-op Study Site

\ \ = Road

STREAM NAME: WHALE CREEK
REACH NUMBER: I
REACH IDENTIFICATION: Sec.30SE., T.36 N., R.22 W. to Sec.26NE., T.36 N., R.22 W.. (mouth confluence w/N. Fork Flathead to approximately 0.2 miles into Sec. 26)

RATING: 86% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	road x-ing
3. NPS Pollution	8/8	
4. Bank Stability	10/12	large erosional bank below N.Fk road
5. Substrate Composition	10/10	
6. Channel Stability	19/24	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	2/4	25-50% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	8/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: WHALE CREEK
REACH NUMBER: II
REACH IDENTIFICATION: Sec.26NE., T.36 N., R.22 W. to Sec.23SW., T.36 N., R.23 W.. (approximately 0.2 miles into Sec. 26 to Akinkoka Creek confluence)

RATING: 86% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest
3. NPS Pollution	6/8	slash
4. Bank Stability	9/12	vert. eros. below road 1671 bridge, blow down disrupts banks
5. Substrate Composition	10/10	
6. Channel Stability	22/24	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	blow down
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	3/8	slash, litter
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **WHALE CREEK**
REACH NUMBER: III
REACH IDENTIFICATION: Sec.23SW., T.36 N., R.23 W. to Sec.29SE., T.36 N., R.23 W.. (Akinkoka Cr. confluence to Shorty Creek confluence)

RATING: 83% = non-impaired, but threatened, (full support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	Ninko Creek erosion contributes to Whale Creek
2. Land Use	1/4	timber harvest
3. NPS Pollution	6/8	slash
4. Bank Stability	9/12	eroding on channel out curves
5. Substrate Composition	10/10	
6. Channel Stability	13/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	
- stream shading	3/4	51-75% shaded
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: **WHALE CREEK**
REACH NUMBER: IV
REACH IDENTIFICATION: Sec.29SE., T.36 N., R.23 W. to Sec.35SE., T.36 N., R.24 W.. (confluence Shorty Creek to approximately 0.5 miles into Sec. 25SE, near end of cutting units)

RATING: 78% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	2/4	tribs. eroding as are side slopes adjacent to stream cutting may influence conditions here
2. Land Use	1/4	timber harvest
3. NPS Pollution	4/8	sed. below Inya Cr. potentially attributable to cuttings in that drainage
4. Bank Stability	12/12	
5. Substrate Composition	6/10	rated for area above falls, embeddedness 1/3-2/3
6. Channel Stability	12/16	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	4/4	
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	4/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

STREAM NAME: WHALE CREEK
REACH NUMBER: V
REACH IDENTIFICATION: Sec.35SE., T.36 N., R.24 W. to Sec.9SW., T.35 N., R.24 W.. (approximately 0.5 miles into Sec. 35SE to unnamed lake SW Sec. 9)

RATING: 74% = minor impairment, (partial support) (Rating based on categories 1 - 8 only)

CATEGORY	**RATING** #/total	**COMMENTS**
1. Natural Erosion	4/4	
2. Land Use	1/4	timber harvest
3. NPS Pollution	4/8	road sediment, slash in stream
4. Bank Stability	7/12	logging has likely influenced bank erosion - increased flow and bank veg. removal
5. Substrate Composition	16/20	riffles <1/3, runs 1/3 embedded habitat impaired?
6. Channel Stability	17/24	
7. (Streamside Veg.)	-	
- % bare ground	4/4	
- avg. width veg. zone	4/4	
- use or damage	3/4	logging, poor SMZ
- stream shading	4/4	
- sed. filtering capacity	3/3	
8. Channel Modifiers	3.5/4	
9. Turbidity	8/8	
10. Water Surface Oil	4/4	
11. Precipitates	4/4	
12. Salinization	N/A	
13. Foreign Debris	2/8	slash
14. Water Odor	4/4	
15. Dewatering	8/8	
16. (Aquatic Organisms)	-	
- fish	N/R	
- plants	2/2	

NARRATIVE DESCRIPTION OF STREAM FEATURES IN WHALE CREEK DURING JUNE 1990

This narrative description of potential sediment sources on Whale Creek begins at the water quality monitoring station established at the bridge on road 1671. Upstream from the station approximately 100 feet is a natural slump that is cut into by the stream at high flow. The bare face of the slide is between 100 and 150 feet high and 75 to 100 feet long. The peak flow level is evidenced by washed gravel four feet above the current flow level. This area is known to have continually deteriorated for the last ten years.

Up stream from the monitoring site the stream bottom opens into a broad, flat valley. Many braided channels meander through thick brush. The bottom material is mostly rounded and generally larger than 2 mm. All low areas adjacent to the stream have water standing in them up to several feet deep. In section 30 the stream has been diverted onto an old timber sale landing area and is running down a road that parallels Whale Creek. The diversion is caused by several factors. First, there are several old spruce trees that have fallen into the stream from the south side bank of the active stream channel. This has pushed the major portion of the flow away from the south bank and caused the north bank to erode. A spruce on the north side fell into the stream, heading upstream. This increased the flow intensity on the bank caused it to erode and eventually a new channel was formed. Lastly there is recent beaver activity in this area. They have attempted to dam the new side channel, causing approximately two to three acres of the landing area to be flooded. There are no obvious signs of ongoing erosion caused by this diversion, mainly because the gradient is so low. The water flows through brush and grass before it re-enters the main stem of Whale Creek and very little sediment should be delivered from this site. Some minor tree removal may be desired to eliminate the flooding, but the entire stream is braided through this section so it's meandering is more or less natural.

The next three miles of stream is characterized by braiding and beaver activity. New channels are being formed and abandoned as has happened during recent history. There are not point sources. The old road crossing in section 27 is well healed and the constriction the remains after the bridge was removed seems to be causing no problems.

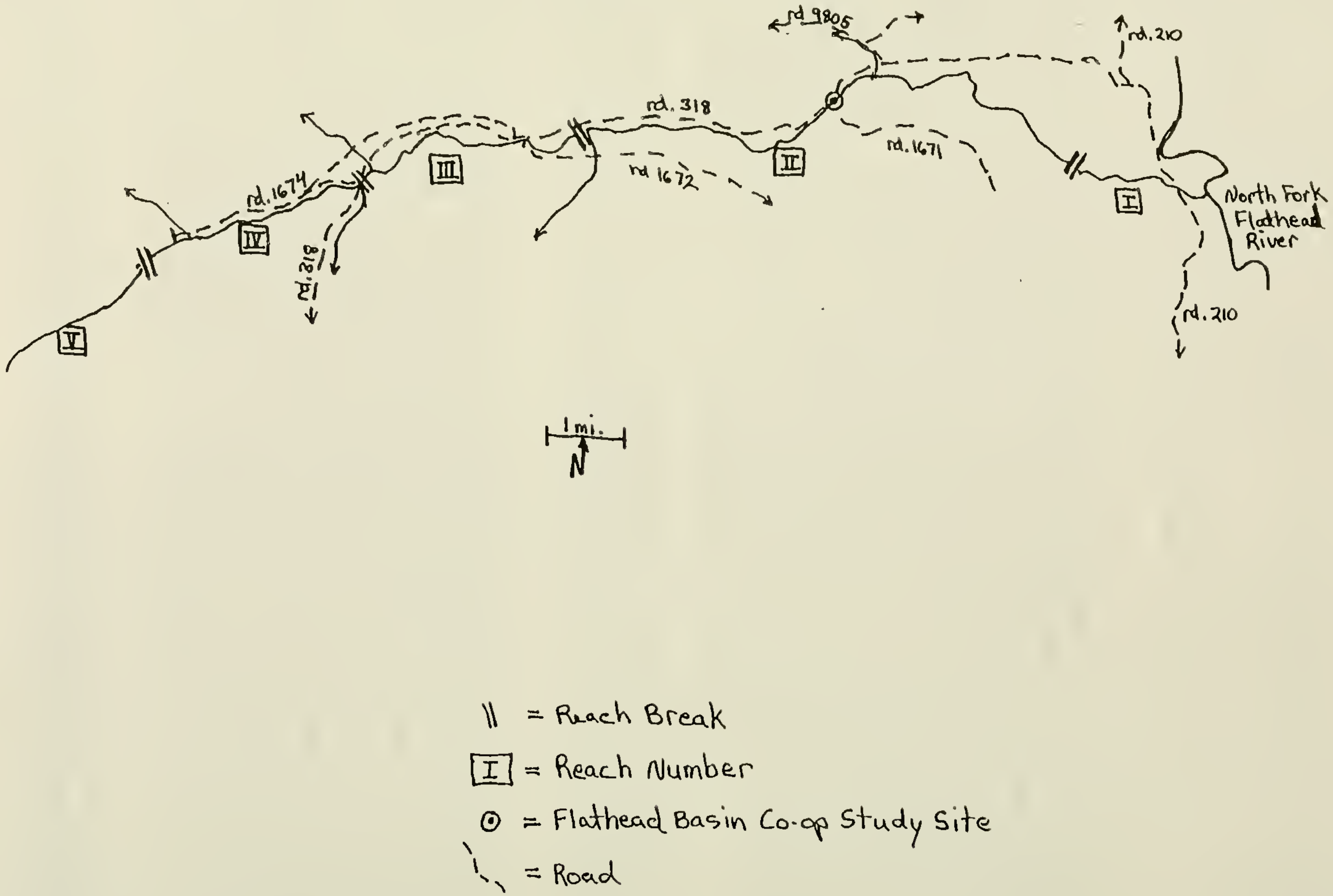
Ninko Creek enters Whale Creek in section 29 in a braided flood plane. There is a large amount of bedload deposition from what can be assumed to be historic flash floods originating in the Ninko Creek drainage. The stream is widely braided through brush and spruce trees for the first 100 yards above its confluence with Whale. Above this point is a 150 foot wide, 300 foot long erosion plane that was created during a flash flood that occurred about 15 years ago. When this event happened the culvert on road 318 was washed out and a great deal of rubble was deposited. This is currently being eroded and down cut at peak flow periods. The berm that was constructed to keep the stream in some type of formal channel is nearly eroded through at the lower end and the main flow is obviously not preferring this route. The bottom material is sharply angular of predominantly larger than 2mm in size. Most very fine material is already washed out except in the berm and the west bank where active cutting is occurring. All course material has dropped from suspension where the stream gradient drops in the trees and brush. Further mitigating measures are recommended if this is determined to be a point source during high flow periods or major precipitation events

Upstream from the culvert crossing the stream channel is actively down-cutting and side-cutting. Many trees have fallen across the channel for about one-half mile. At the foot-bridge crossing active down cutting is also evident. No immediate measures would be successful in slowing this process because the stream is of a very steep gradient (greater than 20%)

Koopee Creek also enters Whale Creek in a broad, braided area. The bed material is sharply angular suggesting that there have been flash floods in the past. At road 318 the channel is deeply incised but well healed. No recent erosion is evident. No photos were taken.

Inuya Creek is another stream that shows signs of rubble transported by flash floods. There is a small amount of active down-cutting where the stream crossed the old road 318 that is now a manway (one or two inches per year is estimated). The stream banks are mostly healed above the crossing. Below this crossing the stream is dispersed through brush and trees. There is a large deposition of rubble where the stream crossed another old road. No preferred channel could be found.

WHALE CREEK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⊙ = Flathead Basin Co-op Study Site
= Road

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